

PSYC 100: Principles of Psychology F23

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PSYC100



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PSYC 100 I

WELCOME TO PSYC100 AT QUEEN'S UNIVERSITY



Welcome to PSYC100 at Queen's University!

We are thrilled to be moving to an Open Access textbook for this course. This means that students do not have to pay for this textbook (saving students an estimated \$272,000 CAD each year in textbook fees for this class!), and that students have multiple options for the medium of access to best suit their needs (e.g., you can read this textbook from the website, you can download it as a PDF, you can use an e-reader, and more!). Importantly, Open Access also means that we've been able to adapt chapters written by leading experts across the world, customizing them for use in PSYC100 here at Queen's.

This shift towards Open Access in PSYC100 has been a large project, with many collaborators. This course was updated with the support of the Queen's University Department of Psychology, Queen's University Arts and Science Online, Student Academic Success Services, faculty and staff from across campus, and our graduate and undergraduate student communities. We are excited to share this content with you, and are proud to be a part of your foundational learning in psychological science!

There is an important collaborative culture inherent in Open Access. Authors initially dedicated time and effort to write these chapters with the intention of them being freely shared and adapted by users to teach about evidence-based psychological science. We want to continue to grow this collaborative culture, including you in the process. Here is how we hope to do this:

- As you go through the content, if you notice substantive (not grammatical) errors such as broken links, etc., please report it to the technical forum in OnQ. If you give us your permission, we will add your name to this chapter as an undergraduate student at Queen's who contributed to this shared resource.
- If you have "I wish I knew more about..." comments, or comments related to the content in PSYC100, please email PSYC100.coord@queensu.ca from your QueensU email account. Though we can't address everything in this course, we will do our best to connect you with helpful information and will consider content edits in future iterations of this book.

A special thanks to two student contributors list: Megan Herrewynen and Stephanie Manuel. These two students were the undergraduate Departmental Student Council (DSC) co-presidents in the 2018-2019 academic year who provided student input on the move towards an Open Access textbook. The Psychology Department is fortunate to have an active DSC, and we thank you all for taking the time and effort to provide helpful feedback!

Psychology can be considered as the scientific study of brains and behaviours. This is an admittedly broad definition: in this course, you will have the opportunity to learn about *just some* of many ways that psychological science plays a role in

our lives. Thank you for being with us as we begin to lay the foundation for further exploration into this discipline.

With best wishes,

Meghan Norris, PhD
Undergraduate Chair in Psychology

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PSYC 100 I

INTRODUCTION TO PSYCHOLOGY

1. Navigating Principles of Psychology

By Jeremy G. Stewart & Melissa Milanovic

Overview

Principles of Psychology (PSYC100) at Queen's University is a course where we regularly hear that: a) students typically really enjoy the course, and b) students find the course challenging. The goal of this module is to provide an overview of some of the challenges of taking PSYC100 at Queen's University and strategies to overcome them. In this chapter, we first describe what you know from experience: University life, in general, is at once exciting and demanding. The demands of University life provide the backdrop for the particular challenges that we think are most central to Principles of Psychology. We divide these challenges into those that have most to do with the academic content and those involving our emotional experiences while taking the course. We end by describing evidence-based strategies to overcome these academic and emotional challenges. We hope that this information will act as a reference or starting point to set you up for the best possible outcomes in this course.

Learning Objectives

1. Describe factors that impact adjustment to post-secondary education, and that predict success.
2. Understand that psychology is a broad science that integrates diverse approaches and methodologies that have their roots in other disciplines (e.g., Biology, Mathematics, Philosophy).
3. Learn the scope of mental health problems faced by University students (including those enrolled in Principles

of Psychology) and how that might affect working with course content.

4. Define trigger warnings and describe the existing evidence for why they are not used in Principles of Psychology.
5. Understand and use (where appropriate) strategies to overcome the academic challenges that this course may present.
6. Understand and use (where appropriate) strategies to overcome the emotional challenges that this course may present.

University Life

Attending university is unquestionably a privilege. For many, their university years are a momentous period wherein their lives are enriched academically, socially, and emotionally. These years are rife with change; many people transition from late adolescence dependent on parents and/or other caregivers to adults entering the workforce to begin their careers. Along with excitement and opportunity, university life also brings a slew of normative demands and stressors. The approaches you take to navigating the academic and emotional challenges of this course, in particular, need to be weighed in the context of adjustment to university life in general.

There is now a large research literature on **academic adjustment**, defined as one's ability to adequately cope with the demands of post-secondary education. The concept encompasses much more than doing well in courses; it also includes one's motivation to learn, satisfaction with University life, and a sense of goals and purpose (e.g., Baker & Siryk, 1986). It also includes non-academic factors, particularly one's social and emotional adaptation to University.

Not surprisingly, better academic adjustment predicts degree completion and academic achievement (Brady-Amoon & Fuentes, 2011; Gerdes & Mallinckrodt, 1994). That said, if you

are in your first year (or even upper years), there are a number of challenges that you may be navigating that can impact your adjustment. These include, but are not limited to:

- Loneliness. This state of mind may be attributed to separation from family, high school and/or hometown friends, and other important people in your life.
- Financial stress. University is expensive and you may be faced with debt, the need to reduce expenses, and/or needing to increase income (e.g., through a part-time job).
- Class format. Many university classes are large (each PSYC100 section has at least 400 students formally enrolled), somewhat impersonal, and have less structure than a typical high school classroom. This format creates many challenges, including opportunities for distraction.
- Freedom. Most students have much more independence in university than they did before. With freedom and flexibility comes the need to regulate key aspects of your life, including sleep, diet, study schedule, and exercise.
- Social opportunities. University involves meeting new people with experiences, beliefs, and passions that may substantially diverge from your own. This opportunity is exciting and leads to forming new peer groups and relationships. At the same time, there is a need to choose whether or not to engage in certain recreation activities, and more broadly, how to balance one's work life and social life.
- Personal and emotional problems. From a developmental perspective, the years during which many attend undergraduate university programs – between late adolescence and late 20s – are critical for developing personal values, beliefs, and goals, as well as intimate, trusting relationships (e.g., Erikson, 1963). Questioning one's purpose, self-worth, relationships, etc. is normal. That said, doing so can also contribute to emotional turmoil

and personal crises (more on personal and emotional challenges below).

In sum, the challenges of this Introductory Psychology course, or any course you might take, do not occur in a vacuum, but instead exist in the context of the many other demands that university life presents. This point is important to remember. We are not suggesting that PSYC100 is the only challenge in your life (we are sure that is far from true) and we do not believe that the strategies we suggest for navigating the course are “one size fits all”. We hope to shed light on some of the more common barriers, and provide a useful starting point for building a set of individualized skills and strategies.

The following video provides some general insights into university life, and ways to approach your studying.



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://ecampusontario.pressbooks.pub/testbookje/?p=4936#h5p-365>

Challenges in Principles of Psychology

At Queen’s University (and, we suspect, at many other institutions) Principles of Psychology is not a “bird course” (i.e., a course in which it is very easy to get a high grade). In fact, www.birdcourses.com rates the course a “C” for “birdiness” — their scale is the academic letter grade system, with F being the most difficult / least “birdy” course — based on input from students who have taken it in the past decade. Overall, we agree with this assessment – from our perspective, Principles of Psychology is one of the more rewarding and interesting

courses offered at Queen's. However, part of what makes it this way is also why it presents both academic and emotional challenges for students.

Academic Challenges

Psychology is a science. Perhaps the most common source of academic difficulties in Principles of Psychology stems from a fundamental misunderstanding of what psychology is. Many find the degree to which topics like neuroanatomy, endocrinology, reproductive biology, genetics, statistics, and research methods (to name a few!) are emphasized in Principles of Psychology surprising. There is a misconception that knowledge of these topics is only relevant to “hard sciences” like Biology, Chemistry, Physics, Mathematics, etc. While understandable, this view is an unhelpful, false dichotomy that we strive to debunk in this course.

The study of psychology is firmly grounded in empiricism and the scientific method. In order to understand and interpret research in psychology, it is critical to have a firm grasp of research design, hypothesis testing, and statistics. Further, one of the most exciting things about Psychology is that it is multi-disciplinary. Our thoughts and behaviors are complex, and to understand them, scientists must draw on theory and methods from diverse disciplines. One example of drawing on information from diverse fields is the National Institute of Mental Health's influential Research Domain Criteria (RDoC) project. Launched in 2008, the RDoC framework has shaped how scientists study the causes and symptoms of mental illnesses. A core RDoC tenant is that mental illness must be classified and studied at multiple “units of analysis” (e.g., molecules, cells, brain circuits, behaviours). Guided by this comprehensive understanding of mental illness, scientists and clinicians have made breakthroughs in treatment and prevention.

What does all of this mean? The bottom line is that some of the content in Principles of Psychology will overlap (and

even extend) material that you may see in courses in Biology, Chemistry, Statistics, Mathematics, and others. For instance, you will learn about the anatomy and physiology of structures involved in sensation and perception, and about the statistical properties of a normal curve. Learning content that overlaps with a range of other disciplines is undoubtedly a tall order for students to tackle, but the variability and multi-disciplinary nature of psychological science is what makes it a fascinating and rewarding area of study.

Psychology is very broad. Related to the point above, Principles of Psychology covers considerable ground in the 24 weeks allotted to lectures and labs. Topics touch on many of the major disciplines in psychology, including Sensation and Perception, Clinical Psychology, Neuroscience, Developmental Psychology, Personality and Social Psychology, Learning/Behavioural Psychology, and Cognitive Psychology. These areas of psychology are in and of themselves very broad (indeed, our department devotes several upper year courses to each) and include multiple sub-disciplines. The course also touches on the history of psychology, research methods, and statistics. So, a lot to accomplish in a short period of time!

One challenging aspect is learning and mastering a lot of information. The diversity of topics covered makes this learning tricky, as you might feel as though you are “shifting gears” frequently, rather than cruising seamlessly from one content area to the next. This challenge makes students more flexible, efficient, and altogether better learners, and this is one of the benefits of studying psychology. So the potential added layer of difficulty in the short-term is worthwhile in the long term! Second, lectures, readings, learning labs, and quizzes will emphasize common threads or connections among course topics. We have made an effort to have content build on itself wherever possible, and to demonstrate how very diverse areas of psychology share common basic principles and themes.

Multiple Methods of Learning. Especially in the blended

version of Principles of Psychology (students attend lecture), the material is presented and learned in several formats. Relative to traditional models, this instructional approach improves performance and attendance, partly because students prefer blended courses to traditional courses (Stockwell et al., 2015). However, active engagement with course material (e.g., preparing for and participating in learning labs; completing quizzes; preparing for lecture by reviewing and annotating textbook readings) takes time. It also is harder than passively absorbing content by simply “showing up” for weekly lectures and labs. Making full use of the different ways of learning offered in Principles of Psychology may mean prioritizing them regularly from week-to-week.

Fully benefitting from the richness Principles of Psychology demands organization, scheduling, and planning ahead. University life is busy and presents opportunities and challenges that you will be juggling while enrolled in this course. And Principles of Psychology is *only one of the courses* in which you are enrolled! Thus, in many ways, this course (and most others) asks you to reflect on what’s important to you and purposefully adjust your behavior so that it is in line with your priorities and goals. This reflection takes self-knowledge and maturity; it’s disarmingly difficult at times to act in a value-consistent manner. In fact, some psychotherapies aim to reduce symptoms of depression and anxiety in part by helping patients identify values and change behaviour in accordance with them (e.g., Acceptance and Commitment Therapy; Hayes, Strosahl, & Wilson, 2011). Structuring your time (see “Strategies to Overcome Academic Challenges” below) is a great place to start. If nothing else, it can make a proverbial mountain look more like a molehill, and is a good way to set yourself up for success in this course.

Emotional Challenges

Principles of Psychology may be more emotionally taxing than many or all of your other courses. Generally, this response

is because much of (but not all) of the content tackles *human processes* – how we perceive, think, feel, and behave. In short, the course content can be highly relatable, and you may make connections with what you've learned about yourself, your loved ones, and/or other important people in your life. In our experience, this relatability interacts with what students bring into the course. We can all probably think about significant hardships we've endured and moments in our lives that have tested us to our limits; we all bring our unique emotional histories. Here, we focus briefly on what we know about the mental health of university students and aspects of the course content that may be especially challenging for those with lived experience with mental illness.

University Mental Health. In late 2014, the World Health Organization's (WHO) World Mental Health International College Student (WMH-ICS) surveys were launched. The initial round of surveys were completed by over 14,000 first-year university students across 19 institutions in 8 countries. The scope and rigor of these surveys has already provided unparalleled insight into the mental health of university students and the impact mental illness has on adjustment and functioning.

The results are sobering. More than 1 in 3 (35.3%) of first year students reported at least one diagnosable mental illness (according to the Diagnostic and statistical manual of mental disorders [4th ed.]; DSM-IV; American Psychiatric Association, 1994) in their lifetimes. Among these, the most common were Major Depressive Disorder (21.2%) and Generalized Anxiety Disorder (18.6%), mental illnesses characterized by low mood and/or a lack of pleasure and persistent, frequent anxiety, respectively. Although less common, alcohol and substance use disorders affected more than 1 in 5 students (Auerbach et al., 2018). Critically, more than 80% of these mental illnesses began prior to the start of university, and fewer than 1 in 5 students with at least one mental illness reported receiving

even minimally adequate treatment in the year prior to being surveyed. Perhaps consequently, pre-matriculation mental illnesses are related to University attrition (Auerbach et al., 2016).

The WMH-ICS surveys also have shed light on how common suicidal thoughts and behaviors may be among incoming students. In their lifetimes, nearly one-third (32.7%) of students reported seriously thinking of killing themselves on purpose (i.e., suicidal ideation) while 17.5% (more than 1 in 6) reported having made a plan to die by suicide (e.g., what method they would use and where they would do it). Finally, *before starting University*, more than 1 in 25 students (4.3%) reported having done something to purposefully injure themselves with some intent to die by their own hands (i.e., a suicide attempt) (Mortier et al., 2018). Further, an additional 4.8% to 6.4% of students experienced *first onsets* of suicidal thoughts or behaviours during university annually (Mortier et al., 2016). That means that each year, we would expect approximately 1 in 5 students who had never experienced suicidal thoughts and behaviours in their lives to first report them in any given university year.

These are alarming statistics. It may not be surprising that the presence of mental illness(es) and/or suicidal thoughts and behaviours are associated with poorer academic performance (Bruffaerts et al., 2018; Mortier et al., 2015) and not completing one's program of study (Auerbach et al., 2016). However, mental illness and suicide can impact our lives in indirect ways, even if we are not personally coping with these. Given how widespread these problems are, if we ourselves are not experiencing symptoms related to mental illness and/or suicidal thoughts and behaviours, someone we love and are very close to—a parent, sibling, partner, friend—certainly is.

There are two take-home points from this discussion. First, mental health problems are common. If you are coping with them, you certainly aren't alone. Research suggests that mental illness reduces student academic success and

adjustment in university overall, but very few people receive the treatment that might help. Accessing personal support systems and professional help will increase your ability to navigate university life (see strategies below as well). Second, your lived experiences with symptoms related to mental illness will provide a unique lens through which to view the material; it may also leave you open to strong and/or unexpected reactions to aspects of the course content. It's impossible to predict what may be most jarring; nonetheless, below we turn to some notable parts of the course content that may be most emotionally challenging.

Course content. As much of the content of Principles of Psychology concerns the study of *us* – what we think and feel, how we act, and what we experience – parts of the material may resonate with you deeply. Indeed, we hope this is the case! The potential downside is you may come across content that you find challenging or activating.

Given the prevalence of mental illness and suicide in the general population, an obvious area in which you may face some tough course content is the Clinical Psychology section. This section will: give a broad overview of the history of mental illness; cover the symptoms, course, and causes of several psychiatric conditions; and discuss available treatments. Hearing about the specific symptoms of mental illnesses and the impacts these can have on people's lives can remind us of our own personal experiences and/or what our loved ones have been through. In general, hearing about precursors to psychiatric symptoms – for example, child abuse, major traumatic events (e.g., being the victim of violence), and substance use – can be upsetting. Hearing about the hardships people face and the fundamental inequalities that can bring on and perpetuate mental illness can be moving. A challenge of this course, and this section in particular, is noticing how these things impact us, taking care of ourselves as needed, and using our experiences as fuel for our scholarship. These

challenges are tricky to accomplish, and we provide some strategies that could prove helpful below.

The emotional challenges of the course content do not end necessarily with the Clinical Psychology section. For example, a major topic in Social Psychology concerns how people create “in groups” (others with whom one feels they have a lot in common) and “out groups” (others who share few of one’s broad characteristics and/or beliefs). Creating these dichotomies has an important evolutionary and interpersonal function. Nonetheless, our tendency to think in terms of “in groups” and “out groups” can contribute to stereotypes, bigotry, and hatred. Many of us and particularly those with lived experience of discrimination may find this difficult to discuss and learn about. As another example, a large and vibrant area of research in Developmental Psychology concerns how children form caring relationships with their parents, and how those relationships are fostered (or thwarted) by parenting practices over time. Learning about attachment styles (e.g., Bowlby, 1969) can be quite provocative depending on your experiences with being cared for and parented when you were young.

The key take away is that, more than many other courses, the content within Principles of Psychology may trigger strong feelings and reactions. We think that the strong emotions psychology may generate is a strength of psychology and something that can make it intrinsically fascinating. We also think that the potential for content to be provocative is something to keep in the back of your mind and watch in a very purposeful way (see more below).

Strategies for Successfully Navigating this Course

Strategies to Overcome Academic Challenges

The change from a high school to university course load can feel dramatic. Suddenly there are extensive readings to complete each week, assignments to stay on top of, and examinations to prepare for, across multiple courses. It can be

easy to become overwhelmed with the amount of academic material to manage. The following are some strategies to help manage your academic demands to help facilitate your ability to manage your time effectively.

Scheduling your time. It is very helpful to get into the habit of creating a weekly schedule. This scheduling not only helps you to sort out what work you plan to focus on each week, and when, but also ensures you are scheduling balanced activities into your life outside of your academics. Having a schedule can lead you to be more productive with your time and manage feelings of being overwhelmed by all of the things you need to do each week.

The Student Academic Success Services at Queen's University provides a helpful technique for generating a weekly schedule (<http://sass.queensu.ca/wp-content/uploads/2019/02/Weekly-Schedule-Template-2019.docx.pdf>) that helps you to make sure you are scheduling your time to include all of your fixed commitments (such as classes, appointments, and team meetings), health habits (such as eating, sleeping, exercise and relaxing), time for homework and everything else (including grocery shopping, laundry, and socializing).

Keeping focused. Do you get easily distracted? Perhaps when you sit down to do some work, your mind wanders to all the other things you need to do, such as “will I remember to text my friend later to hang out?” or “I have to remember to do that online quiz before tomorrow night”. Using a distraction pad to write down wandering thoughts and to-do items while you are working can help you to make sure you are not forgetting anything important, by writing them down for later. This practice also keeps you from getting distracted by going to do the task that has popped into your mind while working on something else.

Getting distracting thoughts out of your head by writing them down on paper can help you focus on the task at hand. You can then set a specific time each evening to review your

distraction pad, at which time you can decide which items are insignificant and can be forgotten, and which items are important. You can then turn the important items into specific actions, and plan for when you will tackle them by slotting them into your weekly schedule.

Not only can your thoughts distract you from attending to your work, but electronic devices also can be very distracting. It is important that each time you sit down to complete a session of work, you decide if you need your digital device in order to do it. If you do not need it, consider leaving your phone or computer in another room, or at home if you plan to work somewhere outside of your home. If you do need your device, consider blocking unnecessary sites with digital applications, or schedule short breaks (e.g., 5-10 minutes) approximately every hour to check for notifications on social media. Of course, everyone's attention span is different, so it is important that you find the limits of your attention for a particular task. Once you have figured out how long you can focus for on the particular activity or subject, you can break down your tasks into goals or chunks of work that you anticipate will take that long to complete.

Effective Studying. *Finding a place to work.* Where do you study most often? When you are sitting down to do your school work, consider your environment. Are you someone who needs a quiet space, or do you prefer to be around people and music? How distracted do you get by your phone and computer? Reflect on what the ideal work environment is for you, and plan to find a space that is most conducive to your own ability to focus when planning to do your coursework. You may not know what works best for you yet, and that is okay! Try out a few spaces (e.g., residence room, coffee shop, library cubicle, study rooms on campus) before making your decision.

Setting yourself up for success. Before you start a session of work, set a goal for yourself. For example, *I would like to read this week's chapter for Psych 100 in the next 50 minutes.* Set a

time commitment to your goal, minimize distractions, and be sure to schedule yourself a break so that you can rest your mind before moving on to the next task.

The skills discussed so far take practice to develop, and they may be new skills for you. Now is a great time to connect with people who are trained to teach and develop good study habits. At Queen's University, we have an entire team dedicated to helping students learn how to learn. The team is called Student Academic Success Services, or SASS for short. SASS has a number of learning and writing resources to assist you with your academics, including free 1-on-1 appointments with learning strategists for Queen's students (<https://sass.queensu.ca/>).

Strategies to Overcome Emotional Challenges

Forewarned is forearmed. Among the emotional challenges of Principles of Psychology is encountering material that could be upsetting to you. Upsetting content could be something you read in your textbook, read or watch online, or hear in lecture. Oftentimes course content that is most likely to affect us connects with some important experiences we have had, or that have happened to people we love, or both.

A deceptively simple strategy for addressing the emotional challenges of this course is looking well ahead in your syllabus. Doing so might allow you to identify, well in advance, topics that you might find difficult to learn and/or read about because of personal experiences. This approach would give you time to find out more about the content by asking your teaching assistants, instructors, or course coordinators (e.g., Undergraduate Chair in Psychology). Knowing what's coming might allow you to prepare for certain topics. For instance, you might decide to review and practice some recommended coping skills (described below) and/or recruit a friend, partner, or other source of support to attend a lecture with you. Further, you might schedule activities that you find fun or distracting

on days you know you will be encountering content you are likely to find distressing.

Although you may come across them in other courses, *Principles of Psychology* does not give **trigger warnings** for any course content. The reasons are both scientific and pedagogical. From a scientific standpoint, studies that have investigated the effects of trigger warnings are mixed, but the bottom line is they either have no impact or a slightly negative impact on overall student well-being. On the pedagogical side, the use of trigger warnings may lead to the avoidance of course material which impedes learning this material. Beyond course material, a more important learning opportunity also may be missed. Since trigger warnings may encourage avoidance of things that are upsetting, there are no opportunities to experience potential “triggers” and learn that you can cope, that the threat is not as bad as you thought, or that the intense emotional reaction you have does not last forever. Indeed, this principle of **exposure** to things that may be triggering or upsetting is a cornerstone of psychological treatments for post-traumatic stress disorder (PTSD) and anxiety disorders (e.g., Abramowitz, Deacon, & Whiteside, 2019; Foa, Hembree, & Rothbaum, 2007). Further, avoidance is a key mechanism that drives the persistence and worsening of many mental health symptoms (e.g., Ottenbreit, Dobson, & Quigley, 2014). For the interested reader, Box 1 presents more information about trigger warnings and further rationale for why these are not used in *Principles of Psychology*.

Trigger Warnings

Trigger warnings are advance notifications at the start of a video, piece of writing, or, in educational

contexts, a lecture or topic, that contains potentially distressing material. Trigger warnings involve a description of the potentially distressing content with the goal of providing the opportunity to prepare for or avoid this content. On the surface, if trigger warnings help people cope with challenging information, this might reduce negative reactions and ultimately protect mental health.

Our primary reason for not using trigger warnings is the lack of scientific evidence that they do what they are supposed to. If trigger warnings protected students from discomfort or distress, using them might have benefits that outweigh their psychological costs (see below). For instance, in a series of carefully designed experiments, Bridgland and colleagues (2019) gave some participants trigger warnings about a graphic photo and measured their levels of negative affect (e.g., adjectives like “distressed”) and anxiety before and after viewing the photo. Another group of participants did not receive any warning. In five separate studies, the groups (warned and unwarned) did not differ in their emotional reactions to graphic, upsetting content. This general effect – that trigger warnings do not impact emotional reactions to potentially upsetting content – has been replicated in studies using a graphic written passage (Bellet, Jones, & McNally, 2018) and videos (Sanson, Strange, & Garry, 2019). Sanson and colleagues (2019) summarize their series of six well designed studies as follows: “people who saw

trigger warnings, compared to people who did not, judged material to be similarly negative, experienced similarly frequent intrusive thoughts and avoidance, and comprehended subsequent material similarly well.” Ultimately, trigger warnings are not helping to reduce or offset the things that they are supposed to (e.g., distress, intrusive memories), which raises questions about their appropriateness for educational contexts.

You may be thinking that, even if they are not overtly helpful, trigger warnings can’t hurt, so why not use them? Although “hurt” may be an exaggeration, there is emerging evidence that trigger warnings may have unintended negative consequences. The initial impetus for trigger warnings came out of clinical research on post-traumatic stress disorder (PTSD). Briefly, some people with PTSD experience intense recollections (e.g., flashbacks; sensory experiences) of a traumatic event that are triggered by reminders of the trauma. Thus, it was thought warnings of these types of triggers might be helpful. However, critics of trigger warnings have long maintained that trigger warnings encourage avoidance (which fuels the persistence of symptoms and impedes learning coping strategies necessary for treatment) and increase the salience of trauma to an individual’s identity. The result is that PTSD symptoms worsen over time and people do not recover (McNally, 2014, 2016; Rosenthal et al., 2005). In line with these criticisms, studies have uncovered some of the

negative side effects of trigger warnings. First, compared to the unwarned, those who receive trigger warnings report greater negative affect and anxiety *before* viewing the potentially distressing content (Bellet et al., 2018; Bridgland et al., 2019; Gainsburg & Earl, 2018). Second, people who receive trigger warnings avoid the content more (Bridgland et al., 2019; Gainsburg & Earl, 2018); in the context of a University course, this translates to missed learning opportunities in the absence of documented benefits. Finally, trigger warnings may affect people's beliefs about their own resilience versus vulnerability. In one study, compared to unwarned participants, people who viewed trigger warnings rated themselves, and people in general, as more emotionally vulnerable following traumatic events (Bellet et al., 2018).

In balance, we think trigger warnings likely do very little to make tough content easier to consume. Further, we are concerned about the potential unintended side effects of such warnings. For those reasons, trigger warnings are not used in Principles of Psychology.

If not trigger warnings, then what?

There are ways to cope with potentially upsetting content that do not involve trigger warnings. Strategies that we recommend including:

- Looking ahead at the syllabus
- Reading keywords at the end of each chapter to see if content may be difficult

- Connecting with a member of the instructional team if there is a specific area you are concerned about

If you know you will encounter information that may be distressing, some strategies for engaging with that content include:

- Bringing a friend or family member to lecture on a day where content may be difficult
- Planning light and fun activities following what may be a difficult lecture
- Using coping and relaxation techniques, described below

Coping and Mental Hygiene. Coping means dedicating time and conscious effort to the management of your stress levels and problems that you are faced with. Stress can surface as a result of many factors, including homework, exams, work, volunteer positions, extracurricular activities, and problems in family and peer relations. When we are coping, we are utilizing techniques and engaging in activities that will help us minimize the effects of these stressors on our wellbeing.

A significant part of coping is recognizing the importance of mental hygiene. You are likely familiar with the term *hygiene*, which refers to practices we engage in that are important for maintaining our health and preventing diseases, such as showering and brushing our teeth. Mental hygiene follows the same general principle, referring to practices we engage in that are important for maintaining our mental health and

preventing psychological conditions such as burnout and mental illness.

In this module we will discuss some coping skills that you can use to facilitate mental hygiene and manage your own wellness.

Self-care. You have likely heard of the term self-care. What does it mean to you?

True self-care is not salt baths and chocolate cake, it is making the choice to build a life you don't need to regularly escape from – Brianna Wiest

Self-care tends to get a reputation in society and the media as simply being the act of taking a bubble bath or eating chocolate to reward oneself. However, self-care is actually multi-faceted, consisting of all of the activities needed to promote and maintain your health, across multiple domains. It is about developing for yourself a life that you feel you can manage, enjoy, and not need to escape from. Self-care activities are not just physical activities, but also mental, emotional, and spiritual. These activities include nutrition, sleep, hygiene, exercise, time with family and friends, as well as time alone and leisure. To engage in self-care is to deliberately choose activities that are nourishing, restorative, and that strengthen your connections with others.

One of the things that makes self-care tricky is that there are many different areas. If you're spending all your time and energy on your physical health and school, you may find you're not getting enough social time! Similarly, if you are staying up really late every night of the week to spend time with friends, the exhaustion is going to catch up with you. An important part of engaging in self-care is finding what activities are restorative for you and being sure to schedule them into your week so that your schedule is well-balanced.

Our culture tends to reward people who deal with their stress by working harder and faster to produce more in a shorter time. You might feel compelled to do this, by engaging in cramming

sessions to pump out work, and cutting out healthy habits in favour of freeing up more time to focus on studies. However, this behaviour can have a negative effect on your physical and mental health, which can result in burnout, which is a state of physical, mental and emotional collapse caused by overwork or stress.

Our bodies are equipped with something called the fight or flight system, which is activated when we are under stress. This response consists of a series of biochemical changes that prepare our bodies to deal with threat or danger. Primitive people needed rapid bursts in energy to fight or flee from predators such as saber-toothed tigers. This response can help us in threatening situations today, such as having to respond quickly to a car that cuts you off on the highway. However, not only can this system become activated when we are faced with serious dangers in our environment, but it also can activate when we are under a great deal of stress and feeling overwhelmed. Luckily, our bodies are also equipped with a relaxation response which can counter the activation of our fight/flight response.

Take a moment to consider how you relax. Some people enjoy down time, for example, reading an enjoyable book. Others might prefer scheduling time with friends, perhaps going out to dinner or seeing a movie. Some people relax through exercise or yoga. We are all different and what helps one person to relax won't necessarily be what best helps another. It is important to find out what relaxing activities help you to unwind, and to be sure to make time for these activities throughout the week to help maintain mental wellness.

The following are some techniques you can try out, which can help you to manage your stress levels and overcome emotional challenges. These techniques are drawn from evidence-based therapy protocols (e.g., Cognitive Behavioural Therapy, Beck, 1979, Beck, 2011; Dialectical Behaviour Therapy, Linehan, 2015; Acceptance and Commitment Therapy, Hayes,

Strosahl, & Wilson, 2011). These psychological therapies have been extensively researched, and are used to improve individuals' well-being across multiple mental and physical health problems.

Deep breathing. Breathing is a fundamental necessity of life that we can often take for granted. Certain breathing patterns can contribute to feelings of anxiety, panic attacks, low mood, muscle tension and fatigue. When we're anxious or stressed out, our breathing tends to become rapid and shallow. In contrast, when we are relaxed, our breathing is much deeper and slower. A technique that can help manage your stress levels, is to engage in deep breathing. This form of breathing has been found to be effective in reducing symptoms of anxiety and improving feelings of relaxation. When you recognize that you are breathing in a quick and shallow way, consciously make the choice to engage in slower breathing for a few minutes. For each breath, focus on inhaling air deep into the lungs through your nose as the abdomen expands. After holding this breath for a few moments, exhale the air out of your mouth, noticing your abdomen contracting. The process of deep breathing signals to your body that it is safe to relax and activates your relaxation response.

Progressive Muscle Relaxation. Maybe you have noticed when you are in a stressful situation or feeling overwhelmed that there is a tightening in your body. Perhaps you feel it in your shoulders, or back, or maybe you get headaches. When we are stressed, we hold tightness in our muscles and this sends signals to our brain that we are stressed out. Not only can this negatively affect how our bodies feel, but it can also influence our mood and our thoughts that we have. A good way to relax our mind, is to deliberately relax our body, taking purposeful steps to relax our muscles. Using the technique of progressive muscle relaxation, you go through each muscle group in your body, one by one, tensing the muscle groups and holding that tension for a several seconds, followed by

releasing the tension in the muscle group. This relaxing of our tension sends feedback to our brain that we are feeling calm and relaxed.

Visualization. Have you ever heard people say “go to your happy place”? This saying may be a reference to a technique called visualization. Research (e.g., Rossman, 2000) shows that focusing the imagination in a positive way can result in a state of ease, mood regulation, and can have a relaxing effect (e.g., imagining a place where you feel calm and safe). Some people do this on their own by really imagining what this place looks like, feels like, and smells like. Some people prefer to be guided to a calm place with an audio track.

Grounding. Grounding is a set of simple strategies to help detach from emotional pain, such as sadness, anger, or anxiety. When you are feeling overwhelmed with emotion, it can be helpful to find a way to detach so that you can gain control of your feelings and cope. Grounding focuses on distraction strategies that help you cope with intense emotions and anchor you to the present moment. There are several ways that you can ground yourself, and it can be done any time, any place, and anywhere. When engaging in grounding, you want to focus on the present moment, rather than ruminating about the past or worrying about the future.

Mental Grounding

- – Describe your environment in detail using all of your senses. Describe what you see in the room, hear, taste, and smell. What is the temperature? What objects do you see, and what textures do you feel? For example: *I am in the lecture hall. I see three brown walls, one in front and two to either side. I see a professor and she is pacing back and forth. The temperature is cool. I feel the armrests on my chair, and the pen in my hand.*
- – Play a categories game with yourself. Try to think of as many “types of animals”, “cars”, “TV shows”, “sports” as you

can.

- – Describe an everyday activity in great detail. For example, describing a meal that you cook (e.g., *first I boil the water, then I put salt in it, then I pour the pasta noodles in, and while that is cooking I sauté vegetables and add them to tomato sauce*)
- – Use humour. Think of something funny, like a joke or a funny clip from a TV show that you enjoyed.
- – Say a coping statement, such as *I can handle this, I will be okay, I will get through this.*

Physical Grounding

- – Grab tightly the arm rests of your chair
- – Touch objects around you for the tactile sensation, such as writing utensils, your clothing, or items in your pocket.
- – Walk slowly, noticing each footstep that you take and how your foot curves as you bring it down to meet contact with the ground.
- – Eat something and describe the flavour and texture of the bite to yourself as you hold the item of food in your mouth.

Planned exercise. Physical activity, in addition to having significant health benefit, is often recommended for emotional wellbeing as a technique for managing stress levels. Indeed, research has found that college students who exercised at least 3 days per week were less likely to report poor mental health and perceived stress than students who did not (Vankim & Nelson, 2013). Multiple studies indicate that physical activity improves mood and reduces symptoms of anxiety and depression (Rethorst et al., 2009; Rimer et al., 2012; Trivedi et al., 2011; Ross & Hayes, 1988; Stephens, 1988).

The Athletics and Recreation Centre (ARC) at Queen's University offers a wide array of fitness opportunities to

become active throughout the year, from fitness equipment, to swimming, gymnasiums, racquet courts and more (https://rec.gogaelsgo.com/sports/2013/7/26/Fac-Serv_0726133714.aspx)

Cultural, Diversity and Faith-based resources.

Culture influences our experience in many ways and can have a significant impact on our mental health, playing a role in how we relate to others, manage our emotions, and experience and express psychological distress (Roberts & Burleson, 2013). Queen's University has several resources and spaces for individuals seeking cultural and spiritual connection:

- Queen's University African and Caribbean Students Association: <https://myams.org/portfolio-items/african-and-caribbean-students-association/>

Healthy eating. Maintaining a healthy, balanced diet is not only important for physical health, but also emotional and mental health. Negative affect (e.g., anxiety, frustration, sadness, boredom, depression, fatigue, stress) has been related to food consumption in order to distract oneself from, or cope with, it. The foods consumed are often the “comfort foods” with high sugar and fats, that can provide immediate satisfaction and may even manage mood in the short term; however, leading to greater preference for indulgent foods over healthy foods (Gardner et al., 2014). Research also shows that unhealthy dietary patterns are related to poorer mental health in youth (O’Neil et al., 2014). Better overall diet quality and lower intake of simple carbohydrates and processed foods are related to lower depressive symptoms (Jacka et al., 2011; Mikolajczyk, Ansari, & Maxwell, 2009, Christensen & Somers, 1996; Quehl et al., 2017). Canada’s Food Guide 2019 (<https://food-guide.canada.ca/en/>) is a great resource that provides tips and recipes for maintaining a healthy, balanced diet.

Thirty-nine percent of Canadian post-secondary students

experience some degree of food insecurity, which ranges from worry about running out of food and having limited food selection, to missing meals, reducing food intake, or going without food for an entire day or longer due to lack of money for food. Queen's University provides the Swipe it Forward program, for short-term meal support (<https://dining.queensu.ca/swipeitforward/>). The Queen's University Student Government (AMS) offers a confidential and non-judgmental food bank service to members of the university community (<https://myams.org/team-details/food-centre/>)

Using Resources. If you find something in Principles of Psychology, or any course, to be very distressing (e.g., a discussion of mental health symptoms that you recognize in yourself) seeking help and support is also a very useful part of coping and mental hygiene. The staff (teaching assistants, course coordinator, and instructors) involved in Principles of Psychology can be good points of contact, especially for connecting you with University-based supports and accommodations (where relevant). If you are concerned about your mental health, here are some additional contacts that you might find useful:

Your family doctor

Book an appointment with your doctor. They can offer advice or refer you to other more specific services to get help. If you do not have a family doctor in Kingston or the surrounding area, Queen's University Student Wellness Services has a team of doctors and other health professionals: (<http://queensu.ca/studentwellness/health-services>).

University Counselling Service

The Counselling Service at Queen's University can help you to address personal or emotional problems that may be interfering with having a positive experience at Queen's and reaching academic and personal success. This service offers a free and confidential service. The Counselling Service is not only for those with a diagnosis. It can be contacted for any reason: (<http://queensu.ca/studentwellness/counselling-services>)

Additional Counselling Services and Information Sources

Resolve Counselling (previously k3c) in Kingston:
<https://www.resolvecounselling.org/>

Sexual Assault Centre Kingston: <http://sackington.com/>
Teens Health (information resource):
<http://www.teenshealth.org/>

Telephone Lines

*24-hour crisis line in the Kingston area:
613-544-4229*

*Kids Help Phone: 1-800-668-6868
(<https://kidshelpphone.ca/>)*

*Telephone Aid Line Kingston (TALK) line:
613-544-1771
(<http://www.telephoneaidlinekingston.com/>)*

*Good2Talk (specific for post-secondary students):
1-866-925-5454 (<https://good2talk.ca/>)*

IN AN EMERGENCY

If you are experiencing suicidal thoughts and think that you might be unable to keep yourself safe, visit Kingston General Hospital Emergency Department or call 911.

Resources for Relaxation and Coping

BREATHE 2 RELAX – Breathe2Relax includes breathing exercises to help you cope and relax

MINDSHIFT – Mindshift teaches you how to relax and cope with anxiety

VIRTUAL HOPE BOX – Virtual Hope Box helps you with coping, relaxation, distraction, and positive thinking

THINKFULL – ThinkFull teaches you to cope with stress, solve problems, and live well

FLOWY – Flowy is a game that makes breathing fun, which can help with anxiety

Websites and Free Downloads:

2. AnxietyBCYouth :<http://youth.anxietybc.com/don%E2%80%99t-tell-me-relax>
 1. Audio files for mental vacation:
<http://youth.anxietybc.com/mental-vacations>
 2. Visualization for confidence-building:
<http://youth.anxietybc.com/confidence-builders>
3. Progressive Muscle Relaxation For Management of Anxiety and Stress (Long Version WITH Music):
<https://www.youtube.com/watch?v=6053dnI4Rxg&feature=youtu.be>
4. McGill University Audio Files for Relaxation:
<https://www.mcgill.ca/counselling/getstarted/relax-meditate>
5. The benefits of exercising and how to start:
<http://youth.anxietybc.com/being-active-facts>

Resources for Time Management

EVERNOTE – Capture, organize, and share notes from anywhere (computer or phone)

2Do – Task manager that allows you to enter in your thoughts and ideas before you forget

30/30 – A task manager that allows you to set up a list of tasks, and a length of time for each of them. It uses a timer to tell you when to move on to the next task

Websites and Free Downloads

1. **Remember the milk** <https://www.rememberthemilk.com/app/#all>

An online to-do list and task manager (can be accessed by phone and computer)

2. Google Calendar <https://calendar.google.com/calendar>

Online scheduling system, allows you to set reminders for scheduled events

3. **Joe's Goals** <http://www.joesgoals.com>

Online tool to keep track of your goals

4. **Self-control** <https://selfcontrolapp.com>

Blocks access to distracting websites for a set period of time that you choose – while still allowing you access to the internet (for Macintosh computers)

5. **Freedom** <https://freedom.to>

Website blocker to improve focus and productivity.

6. **RescueTime** <https://www.rescuetime.com>

Shows you how you spend your time on your computer and provides tools to help you be more productive.

7. **The Pomodoro Technique** <https://cirillocompany.de/pages/pomodoro-technique>

Use a timer to keep yourself on track, both for your working sessions and for your breaks

Free online timer at <https://tomato-timer.com>

8. **Anki** <https://apps.ankiweb.net>

Create your own cue cards to help studying

9. **Dropbox** <https://www.dropbox.com>

Helpful for working on team projects, and keeps all your files in

one place that can be accessed from anywhere with internet (computers, phones)

10. Student Academic Success Services at Queen's University <http://sass.queensu.ca/>

Access time management templates, strategies, and tools

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2. Why Science?

Original chapter by Edward Diener adapted by the
Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

Scientific research has been one of the great drivers of progress in human history, and the dramatic changes we have seen during the past century are due primarily to scientific findings—modern medicine, electronics, automobiles and jets, birth control, and a host of other helpful inventions. Psychologists believe that scientific methods can be used in the behavioral domain to understand and improve the world. Although psychology trails the biological and physical sciences in terms of progress, we are optimistic based on discoveries to date that scientific psychology will make many important discoveries that can benefit humanity. This module outlines the characteristics of the science, and the promises it holds for understanding behavior. The ethics that guide psychological research are briefly described. It concludes with the reasons you should learn about scientific psychology.

Learning Objectives

- Describe how scientific research has changed the world.

- Describe the key characteristics of the scientific approach.
- Discuss a few of the benefits, as well as problems that have been created by science.
- Describe several ways that psychological science has improved the world.
- Describe a number of the ethical guidelines that psychologists follow.

Scientific Advances and World Progress

There are many people who have made positive contributions to humanity in modern times. Take a careful look at the names on the following list. Which of these individuals do you think has helped humanity the most?

- Mother Teresa
- Albert Schweitzer
- Edward Jenner
- Norman Borlaug
- Fritz Haber

The usual response to this question is “Who on earth are Jenner, Borlaug, and Haber?” Many people know that Mother Teresa helped thousands of people living in the slums of Kolkata (Calcutta). Others recall that Albert Schweitzer opened his famous hospital in Africa and went on to earn the Nobel Peace Prize. The other three historical figures, on the other hand, are far less well known. Jenner, Borlaug, and Haber were scientists whose research discoveries saved millions, and even billions, of lives. Dr. Edward Jenner is often considered the “father of immunology” because he was among the first to conceive of and test vaccinations. His pioneering work led directly to the eradication of smallpox. Many other diseases have been greatly reduced because of vaccines discovered

using science—measles, pertussis, diphtheria, tetanus, typhoid, cholera, polio, hepatitis—and all are the legacy of Jenner. Fritz Haber and Norman Borlaug saved more than a billion human lives. They created the “Green Revolution” by producing hybrid agricultural crops and synthetic fertilizer. Humanity can now produce food for the seven billion people on the planet, and the starvation that does occur is related to political and economic factors rather than our collective ability to produce food.



Due to the breakthrough work of Dr. Edward Jenner, millions of vaccinations are now administered around the world every year preventing the spread of many treatable diseases while saving the lives of people of all ages. [Image: CDC Global Health, <https://goo.gl/hokiWz>, CC BY 2.0, <https://goo.gl/9uSnqN>]

If you examine major social and technological changes over the past century most of them can be directly attributed to science. The world in 1914 was very different than the one we see today (**Easterbrook, 2003**). There were few cars and most people traveled by foot, horseback, or carriage. There were no radios, televisions, birth control pills, artificial hearts or antibiotics. Only a small portion of the world had telephones, refrigeration or electricity. These days we find that 80% of all households have television

and 84% have electricity. It is estimated that three quarters of the world's population has access to a mobile phone! Life expectancy was 47 years in 1900 and 79 years in 2010. The percentage of hungry and malnourished people in the world has dropped substantially across the globe. Even average levels of I.Q. have risen dramatically over the past century due to better nutrition and schooling.

All of these medical advances and technological innovations are the direct result of scientific research and understanding. In the modern age it is easy to grow complacent about the advances of science but make no mistake about it—science has made fantastic discoveries, and continues to do so. These discoveries have completely changed our world.

What Is Science?

What is this process we call “science,” which has so dramatically changed the world? Ancient people were more likely to believe in magical and supernatural explanations for natural phenomena such as solar eclipses or thunderstorms. By contrast, scientifically minded people try to figure out the natural world through testing and observation. Specifically, science is the use of **systematic observation** in order to acquire knowledge. For example, children in a science class might combine vinegar and baking soda to observe the bubbly chemical reaction. These **empirical methods** are wonderful ways to learn about the physical and biological world. Science is not magic—it will not solve all human problems, and might not answer all our questions about behavior. Nevertheless, it appears to be the most powerful method we have for acquiring knowledge about the observable world. The essential elements of science are as follows:

1. *Systematic observation is the core of science.* Scientists observe the world, in a very organized way. We often measure the phenomenon we are observing. We record our observations so that memory biases are less likely to enter in to our conclusions. We are systematic in that we try to observe under controlled conditions,



Systematic observation is the core of science. [Image: Cvl Neuro, <https://goo.gl/Avbjju7>, CC BY-SA 3.0, <https://goo.gl/uhH0la>]

2. *Observation leads to hypotheses we can test.* When we develop **hypotheses** and **theories**, we state them in a way that can be tested. For example, you might make the claim that candles made of paraffin wax burn more slowly than do candles of the exact same size and shape made from bee's wax. This claim can be readily tested by timing the burning speed of candles made from these materials.
3. *Science is democratic.* People in ancient times may have been willing to accept the views of their kings or pharaohs as absolute truth. These days, however, people are more likely to want to be able to form their own opinions and debate conclusions. Scientists are skeptical and have open discussions about their observations and theories. These debates often occur as scientists publish competing findings with the idea that the best data will win the argument.

4. *Science is cumulative.* We can learn the important truths discovered by earlier scientists and build on them. Any physics student today knows more about physics than Sir Isaac Newton did even though Newton was possibly the most brilliant physicist of all time. A crucial aspect of scientific progress is that after we learn of earlier advances, we can build upon them and move farther along the path of knowledge.

Psychology as a Science

Even in modern times many people are skeptical that psychology is really a science. To some degree this doubt stems from the fact that many psychological phenomena such as depression, intelligence, and prejudice do not seem to be directly observable in the same way that we can observe the changes in ocean tides or the speed of light. Because thoughts and feelings are invisible many early psychological researchers chose to focus on behavior. You might have noticed that some people act in a friendly and outgoing way while others appear to be shy and withdrawn. If you have made these types of observations then you are acting just like early psychologists who used behavior to draw inferences about various types of personality. By using behavioral measures and rating scales it is possible to measure thoughts and feelings. This is similar to how other researchers explore “invisible” phenomena such as the way that educators measure academic performance or economists measure quality of life.

One important pioneering researcher was Francis Galton, a cousin of Charles Darwin who lived in England during the late 1800s. Galton used patches of color to test people’s ability to distinguish between them. He also invented the self-report questionnaire, in which people offered their own expressed judgments or opinions on various matters. Galton was able

to use self-reports to examine—among other things—people’s differing ability to accurately judge distances.



In 1875 Francis Galton did pioneering studies of twins to determine how much the similarities and differences in twins were affected by their life experiences. In the course of this work he coined the phrase “Nature versus Nurture”. [Image: XT Inc., <https://goo.gl/F1Wvu7>, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

Although he lacked a modern understanding of genetics Galton also had the idea that scientists could look at the behaviors of identical and fraternal twins to estimate the degree to which genetic and social factors contribute to personality; a puzzling issue we currently refer to as the “nature-nurture question.”

In modern times psychology has become more sophisticated. Researchers now use better measures, more sophisticated study designs and better statistical analyses

to explore human nature. Simply take the example of studying the emotion of happiness. How would you go about studying happiness? One straight forward method is to simply ask people about their happiness and to have them use a numbered scale to indicate their feelings. There are, of course, several problems with this. People might lie about their happiness, might not be able to accurately report on their own happiness, or might not use the numerical scale in the same way. With these limitations in mind modern psychologists employ a wide range of methods to assess happiness.

They use, for instance, “peer report measures” in which they ask close friends and family members about the happiness of a target individual. Researchers can then compare these ratings to the self-report ratings and check for discrepancies.

Researchers also use memory measures, with the idea that dispositionally positive people have an easier time recalling pleasant events and negative people have an easier time recalling unpleasant events. Modern psychologists even use biological measures such as saliva cortisol samples (cortisol is a stress related hormone) or fMRI images of brain activation (the left pre-frontal cortex is one area of brain activity associated with good moods).

Despite our various methodological advances it is true that psychology is still a very young science. While physics and chemistry are hundreds of years old psychology is barely a hundred and fifty years old and most of our major findings have occurred only in the last 60 years. There are legitimate limits to psychological science but it is a science nonetheless.

Psychological Science is Useful

Psychological science is useful for creating interventions that help people live better lives. A growing body of research is concerned with determining which therapies are the most and least effective for the treatment of psychological disorders.

For example, many studies have shown that cognitive behavioral therapy can help many people suffering from depression and anxiety disorders (**Butler, Chapman, Forman, & Beck, 2006; Hoffman & Smits, 2008**). In contrast, research reveals that some types of therapies actually might be harmful on average (**Lilienfeld, 2007**).



Cognitive Behavioral Therapy has shown to be effective in treating a variety of conditions, including depression.[Image: SalFalco, <https://goo.gl/3knLoJ>, CC BY-NC 2.0, <https://goo.gl/HEXbAA>]

In organizational psychology, a number of psychological interventions have been found by researchers to produce greater productivity and satisfaction in the workplace (e.g., **Guzzo, Jette, & Katzell, 1985**). Human factor engineers have greatly increased the safety and utility of the products we use. For example, the human factors psychologist Alphonse Chapanis and other researchers redesigned the cockpit controls of aircraft to make them less confusing and easier to respond to, and this led to a decrease in pilot errors and crashes.

Forensic sciences have made courtroom decisions more valid. We all know of the famous cases of imprisoned persons who have been exonerated because of DNA evidence. Equally dramatic cases hinge on psychological findings. For instance, psychologist Elizabeth Loftus has conducted research demonstrating the limits and unreliability of eyewitness testimony and memory. Thus, psychological findings are having practical importance in the world outside the laboratory. Psychological science has experienced enough success to demonstrate that it works, but there remains a huge amount yet to be learned.

Ethics of Scientific Psychology

Psychology differs somewhat from the natural sciences such as chemistry in that researchers conduct studies with human research participants. Because of this there is a natural tendency to want to guard research participants against potential psychological harm. For example, it might be interesting to see how people handle ridicule but it might not be advisable to ridicule research participants.

1. Scientific psychologists follow a specific set of guidelines for research known as a code of **ethics**. There are extensive ethical guidelines for how human participants should be treated in psychological research (**Diener & Crandall, 1978; Sales & Folkman, 2000**).

Following are a few highlights:

2. *Informed consent*. In general, people should know when they are involved in research, and understand what will happen to them during the study. They should then be given a free choice as to whether to participate.
3. *Confidentiality*. Information that researchers learn about individual participants should not be made

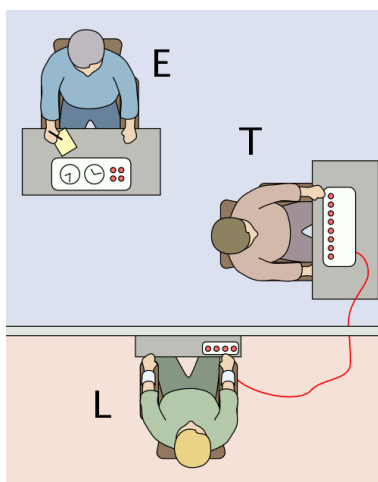


Diagram of the Milgram Experiment in which the “teacher” (T) was asked to deliver a (supposedly) painful electric shock to the “learner”(L). Would this experiment be approved by a review board today? [Image: Fred the Oyster, <https://goo.gl/Z1bQz1>, CC BY-SA 4.0, <https://goo.gl/X3i0tq>]

public without the consent of the individual.

4. *Privacy.* Researchers should not make observations of people in private places such as their bedrooms without their knowledge and consent. Researchers should not seek confidential information from others, such as school authorities, without consent of the participant or their guardian.
5. *Benefits.* Researchers should consider the benefits of their proposed research and weigh these against potential risks to the participants. People who participate in psychological studies should be exposed to risk only if they fully understand these risks and only if the likely benefits clearly outweigh the risks.
6. *Deception.* Some researchers need to deceive participants in order to hide the true nature of the study. This is typically done to prevent participants from modifying their behavior in unnatural ways. Researchers are required to “debrief” their participants after they have completed the study. Debriefing is an opportunity to educate participants about the true nature of the study.

Why Learn About Scientific Psychology?

I once had a psychology professor who asked my class why we were taking a psychology course. Our responses give the range of reasons that people want to learn about psychology:

To understand ourselves

1. To understand other people and groups
2. To be better able to influence others, for example, in socializing children or motivating employees
3. To learn how to better help others and improve the world, for example, by doing effective psychotherapy

4. To learn a skill that will lead to a profession such as being a social worker or a professor
5. To learn how to evaluate the research claims you hear or read about
6. Because it is interesting, challenging, and fun! People want to learn about psychology because this is exciting in itself, regardless of other positive outcomes it might have. Why do we see movies? Because they are fun and exciting, and we need no other reason. Thus, one good reason to study psychology is that it can be rewarding in itself.

Conclusions

The science of psychology is an exciting adventure. Whether you will become a scientific psychologist, an applied psychologist, or an educated person who knows about psychological research, this field can influence your life and provide fun, rewards, and understanding. My hope is that you learn a lot from the modules in this e-text, and also that you enjoy the experience! I love learning about psychology and neuroscience, and hope you will too!

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You

can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Empirical methods

Approaches to inquiry that are tied to actual measurement and observation.

Ethics

Professional guidelines that offer researchers a template for making decisions that protect research participants from potential harm and that help steer scientists away from conflicts of interest or other situations that might compromise the integrity of their research.

Hypotheses

A logical idea that can be tested.

Systematic observation

The careful observation of the natural world with the aim of better understanding it. Observations provide the basic data that allow scientists to track, tally, or otherwise organize information about the natural world.

Theories

Groups of closely related phenomena or observations.

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3. Thinking like a Psychological Scientist

Original chapter by Erin I. Smith adapted by the Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen’s Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

We are bombarded every day with claims about how the world works, claims that have a direct impact on how we think about and solve problems in society and our personal lives. This module explores important considerations for evaluating the trustworthiness of such claims by contrasting between scientific thinking and everyday observations (also known as “anecdotal evidence”).

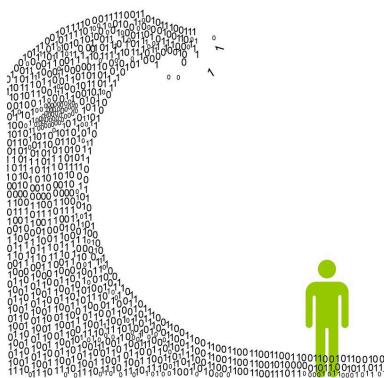
Learning Objectives

- Compare and contrast conclusions based on scientific and everyday inductive reasoning.
- Understand why scientific conclusions and theories are trustworthy, even if they are not able to be proven.
- Articulate what it means to think like a psychological scientist, considering qualities of good scientific explanations and theories.
- Discuss science as a social activity, comparing and

contrasting facts and values.

Introduction

Why are some people so much happier than others? Is it harmful for children to have imaginary companions? How might students study more effectively?



Today, people are overwhelmed with information although it varies in quality. [Image: Mark Smiciklas, <https://goo.gl/TnZCoH>, CC BY-NC 2.0, <https://goo.gl/AGYuo9>]

Even if you've never considered these questions before, you probably have some guesses about their answers. Maybe you think getting rich or falling in love leads to happiness. Perhaps you view imaginary friends as expressions of a dangerous lack of realism. What's more, if you were to ask your friends, they would probably also have opinions about these questions—opinions that may even differ from

your own.

A quick internet search would yield even more answers. We live in the “Information Age,” with people having access to more explanations and answers than at any other time in history. But, although the *quantity* of information is continually increasing, it's always good practice to consider the *quality* of what you read or watch: Not all information is equally trustworthy. The trustworthiness of information is especially important in an era when “fake news,” urban myths, misleading “click-bait,” and conspiracy theories compete for our attention alongside well-informed conclusions grounded in evidence. Determining what information is well-informed is

a crucial concern and a central task of science. Science is a way of using observable **data** to help explain and understand the world around us in a trustworthy way.

In this module, you will learn about scientific thinking. You will come to understand how scientific research informs our knowledge and helps us create theories. You will also come to appreciate how scientific reasoning is different from the types of reasoning people often use to form personal opinions.

Scientific Versus Everyday Reasoning

Each day, people offer statements as if they are facts, such as, “It looks like rain today,” or, “Dogs are very loyal.” These conclusions represent **hypotheses** about the world: best guesses as to how the world works. Scientists also draw conclusions, claiming things like, “There is an 80% chance of rain today,” or, “Dogs tend to protect their human companions.” You’ll notice that the two examples of scientific claims use less certain language and are more likely to be associated with probabilities. Understanding the similarities and differences between scientific and everyday (non-scientific) statements is essential to our ability to accurately evaluate the trustworthiness of various claims.

Scientific and everyday reasoning both employ **induction**: drawing general conclusions from specific observations. For example, a person’s opinion that cramming for a test increases performance may be based on her memory of passing an exam after pulling an all-night study session. Similarly, a researcher’s conclusion *against* cramming might be based on studies comparing the test performances of people who studied the material in different ways (e.g., cramming versus study sessions spaced out over time). In these scenarios, both scientific and

everyday conclusions are drawn from a limited **sample** of potential observations.

The process of induction, alone, does not seem suitable enough to provide trustworthy information—given the contradictory results. What should a student who wants to perform well on exams do? One source of information encourages her to cram, while another suggests that spacing out her studying time is the best strategy. To make the best decision with the information at hand, we need to appreciate the differences between personal opinions and scientific statements, which requires an understanding of science and the nature of scientific reasoning.

There are generally agreed-upon features that distinguish scientific thinking – and the theories and data generated by it—from everyday thinking. A short list of some of the commonly cited features of scientific theories and data is shown in Table 1.

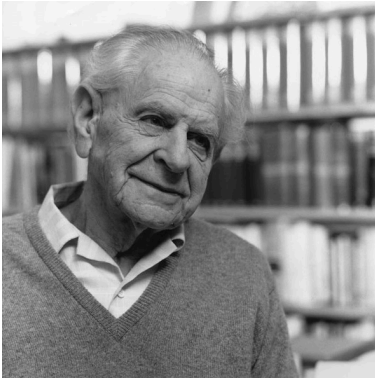
Accuracy	Explanations and theories match real-world observations	E.g. Although people say, “opposites attract,” theories that focus on the role of partner similarity do a better job of explaining the observed data
Consistency	A theory has few exceptions and shows agreement with other theories within and across disciplines.	E.g. The theory of evolution explains many findings across biology and psychology predicting, for example, that humans are better able to solve problems presented in concrete rather than abstract terms
Scope	Extent to which a theory extends beyond currently available data, explaining a wide array of phenomena.	E.g. There is a theory that people use mental “short cuts” when making decision rather than weighing every single piece of evidence. This can be seen in consumer purchasing behavior, in romantic relationships, in charitable donations, and in health choices.
Simplicity	When multiple explanations are equally good at explaining the data, the simplest should be selected.	E.g. The simplest explanation for why “good” people sometimes do “bad” things is because they succumb to some outside influence
Fruitfulness	The usefulness of the theory in guiding new research by predicting new, testable relationships.	E.g. The explanation that competition leads to improved performance can be tested by researching different types of competition

Table 1. Features of good scientific theories ([pb_glossary id="865"]Kuhn, 2011[/pb_glossary])

One additional feature of modern science not included in this list but prevalent in scientists' thinking and theorizing is falsifiability, a feature that has so permeated scientific practice that it warrants additional clarification. In the early 20th century, Karl Popper (1902-1994) suggested that science can be distinguished from **pseudoscience** (or just everyday reasoning) because scientific claims are capable of being **falsified**. That is, a claim can be conceivably demonstrated to be untrue. For example, a person might claim that “all people are right handed.” This claim can be tested and – ultimately – thrown out because it can be shown to be false: There are people who are left-handed. An easy rule of thumb is to not get confused by the term “falsifiable” but to understand that—more or less—it means testable.

On the other hand, some claims cannot be tested and falsified. Imagine, for instance, that a magician claims that he can teach people to move objects with their minds. The trick, he explains, is to *truly believe* in one's ability for it to work. When his students fail to budge chairs with their minds, the magician scolds, "Obviously, you don't truly believe." The magician's claim does not qualify as falsifiable because there is no way to disprove it. It is unscientific.

Popper was particularly irritated about nonscientific claims because he believed they were a threat to the science of psychology. Specifically, he was dissatisfied with Freud's explanations for mental illness. Freud believed that when a person suffers a mental illness it is often due to problems stemming from childhood. For instance, imagine a person who grows up to be an obsessive perfectionist. If she were raised by messy, relaxed parents, Freud might argue that her adult perfectionism is a reaction to her early family experiences—an effort to maintain order and routine instead of chaos. Alternatively, imagine the same person being raised by harsh, orderly parents. In this case, Freud might argue that her adult tidiness is simply her internalizing her parents' way of being. As you can see, according to Freud's rationale, both opposing scenarios are possible; no matter what the disorder, Freud's theory could explain its childhood origin—thus failing to meet the principle of falsifiability.



Karl Popper was an influential thinker regarding scientific theory and reasoning. [Image: Lucinda Douglas-Menzies, <https://goo.gl/uuqxCe>]

Popper argued against statements that could not be falsified. He claimed that they blocked scientific progress: There was no way to advance, refine, or refute knowledge based on such claims. Popper's solution was a powerful one: *If science showed all the possibilities that were not true, we would be left only with what is true.* That is, we need to be able to articulate – beforehand – the kinds of evidence that will

disprove our hypothesis and cause us to abandon it.

This may seem counterintuitive. For example, if a scientist wanted to establish a comprehensive understanding of why car accidents happen, she would systematically test all potential causes: alcohol consumption, speeding, using a cell phone, fiddling with the radio, wearing sandals, eating, chatting with a passenger, etc. A complete understanding could only be achieved once all possible explanations were explored and either falsified or not. After all the testing was concluded, the evidence would be evaluated against the criteria for falsification, and only the real causes of accidents would remain. The scientist could dismiss certain claims (e.g., sandals lead to car accidents) and keep only those supported by research (e.g., using a mobile phone while driving increases risk). It might seem absurd that a scientist would need to investigate so many alternative explanations, but it is exactly how we rule out bad claims. Of course, many explanations are complicated and involve multiple causes—as with car accidents, as well as psychological phenomena.

Test Yourself 1: Can It Be Falsified?

Which of the following hypotheses can be falsified? For each, be sure to consider what kind of data could be collected to demonstrate that a statement is not true.

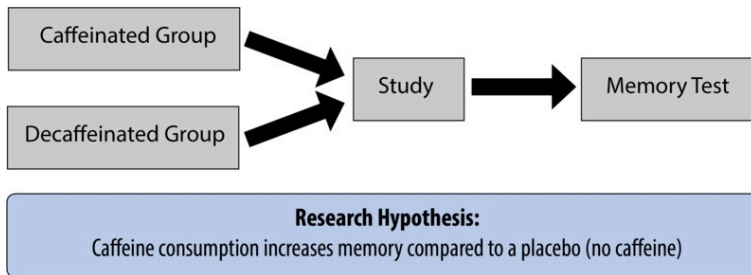
- A. Chocolate tastes better than pasta.
- B. We live in the most violent time in history.
- C. Time can run backward as well as forward.
- D. There are planets other than Earth that have water on them.

[See answer at end of this module]

Although the idea of falsification remains central to scientific data and theory development, these days it's not used strictly the way Popper originally envisioned it. To begin with, scientists aren't solely interested in demonstrating what *isn't*. Scientists are also interested in providing descriptions and explanations for the way things *are*. We want to describe different causes and the various conditions under which they occur. We want to discover when young children start speaking in complete sentences, for example, or whether people are happier on the weekend, or how exercise impacts depression. These explorations require us to draw conclusions from limited samples of data. In some cases, these data seem to fit with our hypotheses and in others they do not. This is where interpretation and probability come in.

The Interpretation of Research Results

Imagine a researcher wanting to examine the hypothesis—a specific prediction based on previous research or scientific theory—that caffeine enhances memory. She knows there are several published studies that suggest this might be the case, and she wants to further explore the possibility. She designs an experiment to test this hypothesis. She randomly assigns some participants a cup of fully caffeinated tea and some a cup of herbal tea. All the participants are instructed to drink up, study a list of words, then complete a memory test. There are three possible outcomes of this proposed study:



1. The caffeine group performs better (support for the hypothesis).
2. The no-caffeine group performs better (evidence against the hypothesis).
3. There is no difference in the performance between the two groups (also evidence against the hypothesis).

Let's look, from a scientific point of view, at how the researcher should interpret each of these three possibilities.

First, if the results of the memory test reveal that the caffeine group performs better, this is a piece of evidence in favor of the hypothesis: It appears, at least in this case, that caffeine

is associated with better memory. It does not, however, *prove* that caffeine is associated with better memory. There are still many questions left unanswered. How long does the memory boost last? Does caffeine work the same way with people of all ages? Is there a difference in memory performance between people who drink caffeine regularly and those who never drink it? Could the results be a freak occurrence? Because of these uncertainties, we do not say that a study—especially a single study—*proves* a hypothesis. Instead, we say the results of the study offer evidence in support of the hypothesis. Even if we tested this across 10 thousand or 100 thousand people we still could not use the word “proven” to describe this phenomenon. This is because inductive reasoning is based on **probabilities**. Probabilities are always a matter of degree; they may be extremely likely or unlikely. Science is better at shedding light on the likelihood—or probability—of something than at proving it. In this way, data is still highly useful even if it doesn’t fit Popper’s absolute standards.

The science of meteorology helps illustrate this point. You might look at your local weather forecast and see a high likelihood of rain. This is because the meteorologist has used **inductive reasoning** to create her forecast. She has taken current observations—lots of dense clouds coming toward your city—and compared them to historical weather patterns associated with rain, making a reasonable prediction of a high probability of rain. The meteorologist has not *proven* it will rain, however, by pointing out the oncoming clouds.

Proof is more associated with deductive reasoning. **Deductive reasoning** starts with general principles that are applied to specific instances (the reverse of inductive reasoning). When the general principles, or *premises*, are true, and the structure of the argument is valid, the conclusion is, by definition, *proven*; it must be so. A deductive truth *must* apply in all relevant circumstances. For example, all living cells contain DNA. From this, you can reason—deductively—that any

specific living cell (of an elephant, or a person, or a snake) will therefore contain DNA. Given the complexity of psychological phenomena, which involve many contributing factors, it is nearly impossible to make these types of broad statements with certainty.

Test Yourself 2: Inductive or Deductive?

1. The stove was on and the water in the pot was boiling over. The front door was standing open. These clues suggest the homeowner left unexpectedly and in a hurry.
2. Gravity is associated with mass. Because the moon has a smaller mass than the Earth, it should have weaker gravity.
3. Students don't like to pay for high priced textbooks. It is likely that many students in the class will opt not to purchase a book.
4. To earn a college degree, students need 100 credits. Janine has 85 credits, so she cannot graduate.

[See answer at end of this module]

The second possible result from the caffeine-memory study is that the group who had *no* caffeine demonstrates better memory. This result is the opposite of what the researcher expects to find (her hypothesis). Here, the researcher must admit the evidence does not support her hypothesis. She must

be careful, however, not to extend that interpretation to other claims. For example, finding increased memory in the no-caffeine group would not be evidence that caffeine harms memory. Again, there are too many unknowns. Is this finding a freak occurrence, perhaps based on an unusual sample? Is there a problem with the design of the study? The researcher doesn't know. She simply knows that she was not able to observe support for her hypothesis.

There is at least one additional consideration: The researcher originally developed her caffeine- benefits-memory hypothesis based on conclusions drawn from previous research. That is, previous studies found results that suggested caffeine boosts memory. The researcher's single study should not outweigh the conclusions of many studies. Perhaps the earlier research employed participants of different ages or who had different baseline levels of caffeine intake. This new study simply becomes a piece of fabric in the overall quilt of studies of the caffeine- memory relationship. It does not, on its own, definitively falsify the hypothesis.

Finally, it's possible that the results show no difference in memory between the two groups. How should the researcher interpret this? How would you? In this case, the researcher once again has to admit that she has not found support for her hypothesis.

Interpreting the results of a study—regardless of outcome—rests on the quality of the observations from which those results are drawn. If you learn, say, that each group in a study included only four participants, or that they were all over 90 years old, you might have concerns. Specifically, you should be concerned that the observations, even if accurate, aren't **representative** of the general population. This is one of the defining differences between conclusions drawn from personal anecdotes and those drawn from scientific observations. **Anecdotal evidence** – derived from personal experience and unsystematic observations (e. g., “common

sense,") – is limited by the quality and representativeness of observations, and by memory shortcomings. Well-designed research, on the other hand, relies on observations that are systematically recorded, of high quality, and representative of the **population** it claims to describe.

Why Should I Trust Science If It Can't Prove Anything?

It's worth delving a bit deeper into why we ought to trust the scientific inductive process, even when it relies on limited samples that don't offer absolute "proof." To do this, let's examine a widespread practice in psychological science: null-hypothesis significance testing.

To understand this concept, let's begin with another research example. Imagine, for instance, a researcher is curious about the ways maturity affects academic performance. She might have a hypothesis that mature students are more likely to be responsible about studying and completing homework and, therefore, will do better in their courses. To test this hypothesis, the researcher needs a measure of maturity and a measure of course performance. She might calculate the **correlation**—relationship—between student age (her measure of maturity) and points earned in a course (her measure of academic performance). Ultimately, the researcher is interested in the likelihood – or probability – that these two variables closely relate to one another. **Null-hypothesis significance testing (NHST)** assesses the probability that the collected data (the observations) would be the same if there were no relationship between the variables in the study. Using our example, the NHST would test the probability that the researcher would find a link between age and class performance if there were, in reality, no such link.

Now, here's where it gets a little complicated. NHST involves a *null hypothesis*, a statement that two variables are *not* related (in this case, that student maturity and academic performance are *not* related in any meaningful way). NHST also involves an *alternative hypothesis*, a statement that two variables *are* related (in this case, that student maturity and academic performance go together). To evaluate these two hypotheses, the researcher collects data. The researcher then compares what she expects to find



Is there a relationship between student age and academic performance? How could we research this question? How confident can we be that our observations reflect reality?
[Image: Jeremy Wilburn, <https://goo.gl/i9MoJb>, CC BY-NC-ND 2.0, <https://goo.gl/SJTsDg>]

(probability) with what she actually finds (the collected data) to determine whether she can falsify, or reject, the null hypothesis in favor of the alternative hypothesis.

How does she do this? By looking at the **distribution** of the data. The distribution is the spread of values—in our example, the numeric values of students' scores in the course. The researcher will test her hypothesis by comparing the observed distribution of grades earned by older students to those earned by younger students, recognizing that some distributions are more or less likely. Your intuition tells you, for example, that the chances of every single person in the course getting a perfect score are lower than their scores being distributed across all levels of performance.

The researcher can use a probability table to assess the likelihood of any distribution she finds in her class. These tables reflect the work, over the past 200 years, of mathematicians

and scientists from a variety of fields. You can see, in Table 2a, an example of an expected distribution if the grades were normally distributed (most are average, and relatively few are amazing or terrible). In Table 2b, you can see possible results of this imaginary study, and can clearly see how they differ from the expected distribution.

In the process of testing these hypotheses, there are four possible outcomes. These are determined by two factors: 1) reality, and 2) what the researcher finds (see Table 3). The best possible outcome is *accurate detection*. This means that the researcher's conclusion mirrors reality. In our example, let's pretend the more mature students do perform slightly better. If this is what the researcher finds in her data, her analysis qualifies as an accurate detection of reality. Another form of accurate detection is when a researcher finds no evidence for a phenomenon, but that phenomenon doesn't actually exist anyway! Using this same example, let's now pretend that maturity has *nothing* to do with academic performance. Perhaps academic performance is instead related to intelligence or study habits. If the researcher finds no evidence for a link between maturity and grades and none actually exists, she will have also achieved accurate detection.

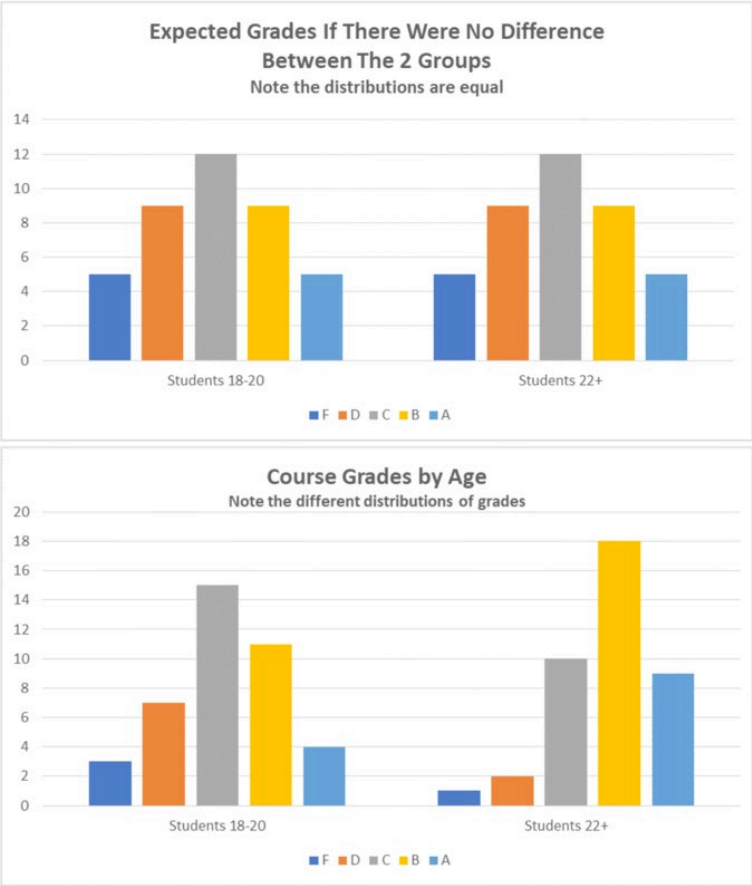


Table 2a (Above): Expected grades if there were no difference between the two groups. Table 2b (Below): Course grades by age

There are a couple of ways that research conclusions might be wrong. One is referred to as a **type I error** – when the researcher concludes there *is* a relationship between two variables but, in reality, there is *not*. Back to our example: Let’s now pretend there’s no relationship between maturity and grades, but the researcher still finds one. Why does this happen? It may be that her sample, by chance, includes older students who *also*

have better study habits and perform better: the researcher has “found” a relationship (the data appearing to show age as significantly correlated with academic performance), but the truth is that the apparent relationship is purely coincidental—the result of these specific older students in this particular sample having better-than-average study habits (the real cause of the relationship). They may have always had superior study habits, even when they were young.

Another possible outcome of NHST is a **type II error**, when the data fail to show a relationship between variables that actually exists. In our example, this time pretend that maturity *is*—in reality—associated with academic performance, but the researcher *doesn't* find it in her sample. Perhaps it was just her bad luck that her older students are just having an off day, suffering from test anxiety, or were uncharacteristically careless with their homework: the peculiarities of her particular sample, by chance, prevent the researcher from identifying the real relationship between maturity and academic performance.

These types of errors might worry you, that there is just no way to tell if data are any good or not. Researchers share your concerns, and address them by using **probability values** (p-values) to set a threshold for type I or type II errors. When researchers write that a particular finding is “significant at a $p < .05$ level,” they’re saying that if the same study were repeated 100 times, we should expect this result to occur – by chance – fewer than five times. That is, in this case, a Type I error is unlikely. Scholars sometimes argue over the exact threshold that should be used for probability. The most common in psychological science are .05 (5% chance), .01 (1% chance), and .001 (1/10th of 1% chance). Remember, psychological science doesn’t rely on definitive proof; it’s about the probability of seeing a specific result. This is also why it’s so important that scientific findings be replicated in additional studies.

		In reality there is . . .	
		a relationship	<u>no</u> relationship
The researcher finds . . .	a relationship (Alternative Hypothesis)	Accurate Detection!	<i>Type I Error</i>
	<u>no</u> relationship (Null hypothesis)	<i>Type II Error</i>	Accurate Detection!

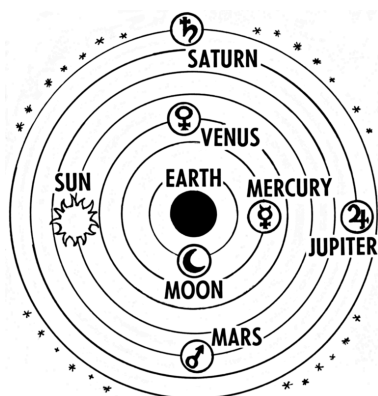
Table 3: Accurate detection and errors in research

It's because of such methodologies that science is generally trustworthy. Not all claims and explanations are equal; some conclusions are better bets, so to speak. Scientific claims are more likely to be correct and predict real outcomes than “common sense” opinions and personal anecdotes. This is because researchers consider how to best prepare and measure their subjects, systematically collect data from large and—ideally—representative samples, and test their findings against probability.

Scientific Theories

The knowledge generated from research is organized according to scientific theories. A **scientific theory** is a comprehensive framework for making sense of evidence regarding a particular phenomenon. When scientists talk about a theory, they mean something different from how the term is used in everyday conversation. In common usage, a theory is an educated guess—as in, “I have a theory about which team will make the playoffs,” or, “I have a theory about why my sister is always running late for appointments.” Both of these beliefs are liable to be heavily influenced by many untrustworthy factors, such as personal opinions and memory

biases. A scientific theory, however, enjoys support from many research studies, collectively providing evidence, including, but not limited to, that which has falsified competing explanations. A key component of good theories is that they describe, explain, and predict in a way that can be **empirically** tested and potentially falsified.



Early theories placed the Earth at the center of the solar system. We now know that the Earth revolves around the sun. [Image: Pearson Scott Foresman, <https://goo.gl/W3izMR>, Public Domain]

Theories are open to revision if new evidence comes to light that compels reexamination of the accumulated, relevant data. In ancient times, for instance, people thought the Sun traveled around the Earth. This seemed to make sense and fit with many observations. In the 16th century, however, astronomers began systematically charting visible objects in the sky, and, over a 50-year period, with

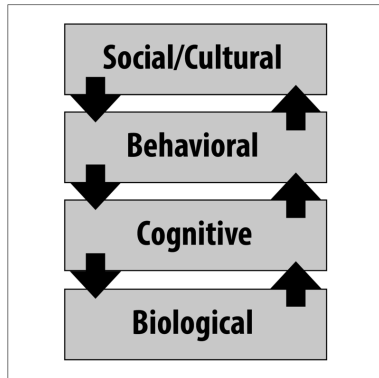
repeated testing, critique, and refinement, they provided evidence for a revised theory: The Earth and other cosmic objects revolve around the Sun. In science, we believe what the best and most data tell us. If better data come along, we must be willing to change our views in accordance with the new evidence.

Is Science Objective?

Thomas Kuhn (2012), a historian of science, argued that science, as an activity conducted by humans, is a social activity. As such, it is—according to Kuhn—subject to the same psychological influences of all human activities. Specifically, Kuhn suggested that there is no such thing as **objective** theory or data; all of science is informed by values. Scientists cannot help but let personal/cultural values, experiences, and opinions influence the types of questions they ask and how they make sense of what they find in their research. Kuhn's argument highlights a distinction between **facts** (information about the world), and **values** (beliefs about the way the world is or ought to be). This distinction is an important one, even if it is not always clear.

To illustrate the relationship between facts and values, consider the problem of global warming. A vast accumulation of evidence (facts) substantiates the adverse impact that human activity has on the levels of greenhouse gases in Earth's atmosphere leading to changing weather patterns. There is also a set of beliefs (values), shared by many people, that influences their choices and behaviors in an attempt to address that impact (e.g., purchasing electric vehicles, recycling, bicycle commuting). Our values—in this case, that Earth as we know it is in danger and should be protected—influence how we engage with facts. People (including scientists) who strongly endorse this value, for example, might be more attentive to research on renewable energy.

The primary point of this illustration is that (contrary to the image of scientists as outside observers to the facts, gathering them neutrally and without bias from the natural world) all science—especially social sciences like psychology—involves values and interpretation. As a



result, science functions best when people with diverse values and backgrounds work collectively to understand complex natural phenomena.

Indeed, science can benefit from multiple perspectives. One approach to achieving this is through levels of analysis. **Levels of analysis** is the idea that a single phenomenon may be explained at different levels simultaneously. Remember the question concerning cramming for a test versus studying over time? It can be answered at a number of different levels of analysis. At a low level, we might use brain scanning technologies to investigate whether biochemical processes differ between the two study strategies. At a higher level—the level of thinking—we might investigate processes of decision making (what to study) and ability to focus, as they relate to cramming versus spaced practice. At even higher levels, we might be interested in real world behaviors, such as how long people study using each of the strategies. Similarly, we might be interested in how the presence of others influences learning across these two strategies. Levels of analysis suggests that one level is not more correct—or truer—than another; their appropriateness depends on the specifics of the question asked. Ultimately, levels of analysis would suggest that we cannot understand the world around us, including human psychology, by reducing the phenomenon to only the

biochemistry of genes and dynamics of neural networks. But, neither can we understand humanity without considering the functions of the human nervous system.

Science in Context

There are many ways to interpret the world around us. People rely on common sense, personal experience, and faith, in combination and to varying degrees. All of these offer legitimate benefits to navigating one's culture, and each offers a unique perspective, with specific uses and limitations. Science provides another important way of understanding the world and, while it has many crucial advantages, as with all methods of interpretation, it also has limitations. Understanding the limits of science—including its subjectivity and uncertainty—does not render it useless. Because it is systematic, using testable, reliable data, it can allow us to determine **causality** and can help us **generalize** our conclusions. By understanding how scientific conclusions are reached, we are better equipped to use science as a tool of knowledge.

The following short video discusses in greater detail the strengths and limitations of an empirical approach, and introduces other important ways of knowing about ourselves, and the world around us.



An interactive H5P element has been excluded from this version of the text. You can view it online here:

<https://ecampusontario.pressbooks.pub/testbookje/?p=285#h5p-366>

Answer – Test Yourself 1: Can It Be Falsified?

Answer explained: There are 4 hypotheses presented. Basically, the question asks “which of these could be tested and demonstrated to be false?”. We can eliminate answers A, B and C. A is a matter of personal opinion. C is a concept for which there are currently no existing measures. B is a little trickier. A person could look at data on wars, assaults, and other forms of violence to draw a conclusion about which period is the most violent. The problem here is that we do not have data for all time periods, and there is no clear guide to which data should be used to address this hypothesis. The best answer is D, because we have the means to view other planets and to determine whether there is water on them (for example, Mars has ice).

Answer – Test Yourself 2: Inductive or Deductive

Answer explained: This question asks you to

consider whether each of 5 examples represents inductive or deductive reasoning. 1) Inductive—it is possible to draw the conclusion—the homeowner left in a hurry—from specific observations such as the stove being on and the door being open. 2) Deductive—starting with a general principle (gravity is associated with mass), we draw a conclusion about the moon having weaker gravity than does the Earth because it has smaller mass. 3) Deductive—starting with a general principle (students do not like to pay for textbooks) it is possible to make a prediction about likely student behavior (they will not purchase textbooks). Note that this is a case of prediction rather than using observations. 4) Deductive—starting with a general principle (students need 100 credits to graduate) it is possible to draw a conclusion about Janine (she cannot graduate because she has fewer than the 100 credits required).

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You

can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Anecdotal evidence

A piece of biased evidence, usually drawn from personal experience, used to support a conclusion that may or may not be correct.

Causality

In research, the determination that one variable causes—is responsible for—an effect.

Correlation

In statistics, the measure of relatedness of two or more variables.

Data (also called observations)

In research, information systematically collected for analysis and interpretation.

Deductive reasoning

A form of reasoning in which a given premise determines the interpretation of specific observations (e.g., All birds have feathers; since a duck is a bird, it has feathers).

Distribution

In statistics, the relative frequency that a particular value occurs for each possible value of a given variable.

Empirical

Concerned with observation and/or the ability to verify a claim.

Fact

Objective information about the world.

Falsify

In science, the ability of a claim to be tested and—possibly—refuted; a defining feature of science.

Generalize

In research, the degree to which one can extend conclusions drawn from the findings of a study to other groups or situations not included in the study.

Hypothesis

A tentative explanation that is subject to testing.

Induction

To draw general conclusions from specific observations.

Inductive reasoning

A form of reasoning in which a general conclusion is inferred from a set of observations (e. g., noting that “the driver in that car was texting; he just cut me off then ran a red light!” (a specific observation), which leads to the general conclusion that texting while driving is dangerous).

Levels of analysis

In science, there are complementary understandings and explanations of phenomena.

Null-hypothesis significance testing (NHST)

In statistics, a test created to determine the chances that an alternative hypothesis would produce a result as extreme as the one observed if the null hypothesis were actually true.

Objective

Being free of personal bias.

Population

In research, all the people belonging to a particular group (e.g., the population of left handed people).

Probability

A measure of the degree of certainty of the occurrence of an event.

Probability values

In statistics, the established threshold for determining whether a given value occurs by chance.

Pseudoscience

Beliefs or practices that are presented as being scientific, or which are mistaken for being scientific, but which are not scientific (e.g., astrology, the use of celestial bodies to make predictions about human behaviors, and which presents itself as founded in astronomy, the actual scientific study of celestial objects. Astrology is a pseudoscience unable to be falsified, whereas astronomy is a legitimate scientific discipline).

Representative

In research, the degree to which a sample is a typical example of the population from which it is drawn.

Sample

In research, a number of people selected from a population to serve as an example of that population.

Scientific theory

An explanation for observed phenomena that is empirically well-supported, consistent, and fruitful (predictive).

Type I error

In statistics, the error of rejecting the null hypothesis when it is true.

Type II error

In statistics, the error of failing to reject the null hypothesis when it is false.

Value

Belief about the way things should be.

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4. History of Psychology

*Original chapter by David B. Baker & Heather Sperry
adapted by the Queen's University Psychology
Department*

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen’s Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

This module provides an introduction and overview of the historical development of the science and practice of psychology in America. Ever-increasing specialization within the field often makes it difficult to discern the common roots from which the field of psychology has evolved. By exploring this shared past, students will be better able to understand how psychology has developed into the discipline we know today.

Learning Objectives

- Describe the precursors to the establishment of the science of psychology.
- Identify key individuals and events in the history of American psychology.
- Describe the rise of professional psychology in America.
- Develop a basic understanding of the processes of

scientific development and change.

- Recognize the role of women and people of color in the history of American psychology.

Introduction

It is always a difficult question to ask, where to begin to tell the story of the history of psychology. Some would start with ancient Greece; others would look to a demarcation in the late 19th century when the science of psychology was formally proposed and instituted. These two perspectives, and all that is in between, are appropriate for describing a history of psychology. The interested student will have no trouble finding an abundance of resources on all of these time frames and perspectives (**Goodwin, 2011; Leahey, 2012; Schultz & Schultz, 2007**). For the purposes of this module, we will examine the development of psychology in America and use the mid-19th century as our starting point. For the sake of convenience, we refer to this as a history of modern psychology.



The earliest records of a psychological experiment go all the way back to the Pharaoh Psamtik I of Egypt in the 7th Century B.C.[Image: Neithsabes, CC0 Public Domain, <https://goo.gl/m25gce>]

Psychology is an exciting field and the history of psychology offers the opportunity to make sense of how it has grown and developed. The history of psychology also provides perspective. Rather than a dry collection of names and dates, the history of psychology tells us about the important intersection of time and place that defines who we are. Consider what happens when you meet someone for the first time.

The conversation usually begins with a series of questions such as, “Where did you grow up?” “How long have you lived here?” “Where did you go to school?” The importance of history in defining who we are cannot be overstated. Whether you are seeing a physician, talking with a counselor, or applying for a job, everything begins with a history. The same is true for studying the history of psychology; getting a history of the field helps to make sense of where we are and how we got here.

A Prehistory of Psychology

Precursors to American psychology can be found in philosophy and physiology. Philosophers such as John Locke (1632–1704) and Thomas Reid (1710–1796) promoted **empiricism**, the idea that all knowledge comes from experience. The work of Locke, Reid, and others emphasized the role of the human observer and the primacy of the senses in defining how the mind comes

to acquire knowledge. In American colleges and universities in the early 1800s, these principles were taught as courses on mental and moral philosophy. Most often these courses taught about the mind based on the faculties of intellect, will, and the senses (Fuchs, 2000).

Physiology and Psychophysics

Philosophical questions about the nature of mind and knowledge were matched in the 19th century by physiological investigations of the sensory systems of the human observer. German physiologist Hermann von Helmholtz (1821–1894) measured the speed of the **neural impulse** and explored the physiology of hearing and vision. His work indicated that our senses can deceive us and are not a mirror of the external world. Such work showed that even though the human senses were fallible, the mind could be measured using the methods of science. In all, it suggested that a science of psychology was feasible.

An important implication of Helmholtz's work was that there is a psychological reality and a physical reality and that the two are not identical. This was not a new idea; philosophers like John Locke had written extensively on the topic, and in the 19th century, philosophical speculation about the nature of mind became subject to the rigors of science.

The question of the relationship between the mental (experiences of the senses) and the material (external reality) was investigated by a number of German researchers including Ernst Weber and Gustav Fechner. Their work was called **psychophysics**, and it introduced methods for measuring the relationship between physical stimuli and human perception that would serve as the basis for the new science of psychology (Fancher & Rutherford, 2011).

The formal development of modern psychology is usually credited to the work of German physician, physiologist, and philosopher Wilhelm Wundt (1832–1920). Wundt helped to establish the field of experimental psychology by serving as a strong promoter of the idea that psychology could be an experimental field and by providing classes, textbooks, and a laboratory for training students. In 1875, he joined



Wilhelm Wundt is considered one of the founding figures of modern psychology. [CC0 Public Domain, <https://goo.gl/m25gce>]

the faculty at the University of Leipzig and quickly began to make plans for the creation of a program of experimental psychology. In 1879, he complemented his lectures on experimental psychology with a laboratory experience: an event that has served as the popular date for the establishment of the science of psychology.

The response to the new science was immediate and global. Wundt attracted students from around the world to study the new experimental psychology and work in his lab. Students were trained to offer detailed self-reports of their reactions to various stimuli, a procedure known as **introspection**. The goal was to identify the elements of **consciousness**. In addition to the study of sensation and perception, research was done on mental chronometry, more commonly known as reaction time. The work of Wundt and his students demonstrated that the mind could be measured and the nature of consciousness could be revealed through scientific means. It was an exciting proposition, and one that found great interest in America. After the opening of Wundt's lab in 1879, it took just four years for

the first psychology laboratory to open in the United States (Benjamin, 2007).

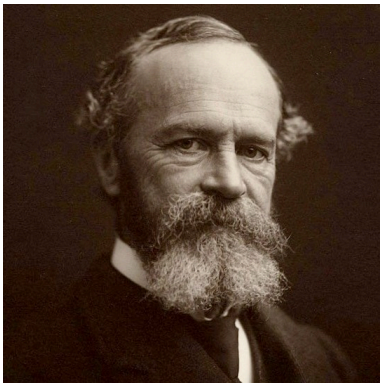
Scientific Psychology Comes to the United States

Wundt's version of psychology arrived in America most visibly through the work of Edward Bradford Titchener (1867–1927). A student of Wundt's, Titchener brought to America a brand of experimental psychology referred to as “**structuralism**”. Structuralists were interested in the contents of the mind—what the mind is. For Titchener, the general adult mind was the proper focus for the new psychology, and he excluded from study those with mental deficiencies, children, and animals (Evans, 1972; Titchener, 1909).

Experimental psychology spread rather rapidly throughout North America. By 1900, there were more than 40 laboratories in the United States and Canada (Benjamin, 2000). Psychology in America also organized early with the establishment of the American Psychological Association (APA) in 1892. Titchener felt that this new organization did not adequately represent the interests of experimental psychology, so, in 1904, he organized a group of colleagues to create what is now known as the Society of Experimental Psychologists (Goodwin, 1985). The group met annually to discuss research in experimental psychology. Reflecting the times, women researchers were not invited (or welcome). It is interesting to note that Titchener's first doctoral student was a woman, Margaret Floy Washburn (1871–1939). Despite many barriers, in 1894, Washburn became the first woman in America to earn a Ph.D. in psychology and, in 1921, only the second woman to be elected president of the American Psychological Association (Scarborough & Furumoto, 1987).

Striking a balance between the science and practice of psychology continues to this day. In 1988, the American Psychological Society (now known as the Association for Psychological Science) was founded with the central mission of advancing psychological science.

Toward a Functional Psychology



William James was one of the leading figures in a new perspective on psychology called functionalism. [Image: Notman Studios, CC0Public Domain, <https://goo.gl/m25gce>]

While Titchener and his followers adhered to a structural psychology, others in America were pursuing different approaches. William James, G. Stanley Hall, and James McKeen Cattell were among a group that became identified with “**functionalism**.” Influenced by Darwin’s evolutionary theory, functionalists were interested in the activities of the mind—what the mind does. An interest in functionalism opened the

way for the study of a wide range of approaches, including animal and comparative psychology (**Benjamin, 2007**).

William James (1842–1910) is regarded as writing perhaps the most influential and important book in the field of psychology, *Principles of Psychology*, published in 1890. Opposed to the reductionist ideas of Titchener, James proposed that consciousness is ongoing and continuous; it cannot be isolated and reduced to elements. For James, consciousness helped us adapt to our environment in such ways as allowing us to make choices and have personal responsibility over those choices.

At Harvard, James occupied a position of authority and respect in psychology and philosophy. Through his teaching and writing, he influenced psychology for generations. One of his students, Mary Whiton Calkins (1863–1930), faced many of the challenges that confronted Margaret Floy Washburn and other women interested in pursuing graduate education in psychology. With much persistence, Calkins was able to study with James at Harvard. She eventually completed all the requirements for the doctoral degree, but Harvard refused to grant her a diploma because she was a woman. Despite these challenges, Calkins went on to become an accomplished researcher and the first woman elected president of the American Psychological Association in 1905 (**Scarborough & Furumoto, 1987**).

G. Stanley Hall (1844–1924) made substantial and lasting contributions to the establishment of psychology in the United States. At Johns Hopkins University, he founded the first psychological laboratory in America in 1883. In 1887, he created the first journal of psychology in America, *American Journal of Psychology*. In 1892, he founded the American Psychological Association (APA); in 1909, he invited and hosted Freud at Clark University (the only time Freud visited America). Influenced by evolutionary theory, Hall was interested in the process of adaptation and human development. Using surveys and questionnaires to study children, Hall wrote extensively on child development and education. While graduate education in psychology was restricted for women in Hall's time, it was all but non-existent for African Americans. In another first, Hall mentored Francis Cecil Sumner (1895–1954) who, in 1920, became the first African American to earn a Ph.D. in psychology in America (**Guthrie, 2003**).

James McKeen Cattell (1860–1944) received his Ph.D. with Wundt but quickly turned his interests to the assessment of **individual differences**. Influenced by the work of Darwin's cousin, Frances Galton, Cattell believed that mental abilities

such as intelligence were inherited and could be measured using mental tests. Like Galton, he believed society was better served by identifying those with superior intelligence and supported efforts to encourage them to reproduce. Such beliefs were associated with **eugenics** (the promotion of selective breeding) and fueled early debates about the contributions of heredity and environment in defining who we are. At Columbia University, Cattell developed a department of psychology that became world famous also promoting psychological science through advocacy and as a publisher of scientific journals and reference works (**Fancher, 1987; Sokal, 1980**).

The Growth of Psychology

Throughout the first half of the 20th century, psychology continued to grow and flourish in America. It was large enough to accommodate varying points of view on the nature of mind and behavior. **Gestalt psychology** is a good example. The Gestalt movement began in Germany with the work of Max Wertheimer (1880–1943). Opposed to the reductionist approach of Wundt's laboratory psychology, Wertheimer and his colleagues Kurt Koffka (1886– 1941), Wolfgang Kohler (1887–1967), and Kurt Lewin (1890–1947) believed that studying the whole of any experience was richer than studying individual aspects of that experience. The saying “the whole is greater than the sum of its parts” is a Gestalt perspective. Consider that a melody is an additional element beyond the collection of notes that comprise it. The Gestalt psychologists proposed that the mind often processes information simultaneously rather than sequentially. For instance, when you look at a photograph, you see a whole image, not just a collection of pixels of color. Using Gestalt principles, Wertheimer and his colleagues also explored the nature of

learning and thinking. Most of the German Gestalt psychologists were Jewish and were forced to flee the Nazi regime due to the threats posed on both academic and personal freedoms. In America, they were able to introduce a new audience to the Gestalt perspective, demonstrating how it could be applied to perception and learning (Wertheimer, 1938). In many ways, the work of the Gestalt psychologists served as a precursor to the rise of **cognitive psychology** in America (Benjamin, 2007).

Behaviorism emerged early in the 20th century and became a major force in American psychology. Championed by psychologists such as John B. Watson (1878–1958) and B. F. Skinner (1904–1990), behaviorism rejected any reference to mind and viewed overt and observable behavior as the proper subject matter of psychology. Through the scientific study of behavior, it was hoped that laws of learning could be derived that would promote the prediction and control of behavior. Russian physiologist Ivan Pavlov (1849–1936) influenced early behaviorism in America. His work on conditioned learning, popularly referred to as classical conditioning, provided support for the notion that learning and behavior were controlled by events in the environment and could be explained with no reference to mind or consciousness (Fancher, 1987).

For decades, behaviorism dominated American psychology. By the 1960s, psychologists began to recognize that behaviorism was unable to fully explain human behavior because it neglected mental processes. The turn toward a cognitive psychology was not new. In the 1930s, British psychologist Frederic C. Bartlett (1886–1969) explored the idea of the constructive mind, recognizing that people use their past experiences to construct frameworks in which to understand new experiences. Some of the major pioneers in American cognitive psychology include Jerome Bruner (1915–2016), Roger Brown (1925–1997), and George Miller

(1920–2012). In the 1950s, Bruner conducted pioneering studies on cognitive aspects of sensation and perception. Brown conducted original research on language and memory, coined the term “**flashbulb memory**,” and figured out how to study the **tip-of-the-tongue phenomenon** (Benjamin, 2007). Miller’s research on working memory is legendary. His 1956 paper “The Magic Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information” is one of the most highly cited papers in psychology. A popular interpretation of Miller’s research was that the number of bits of information an average human can hold in working memory is 7 ± 2 . Around the same time, the study of computer science was growing and was used as an analogy to explore and understand how the mind works. The work of Miller and others in the 1950s and 1960s has inspired tremendous interest in cognition and neuroscience, both of which dominate much of contemporary American psychology.

Applied Psychology in America

In America, there has always been an interest in the application of psychology to everyday life. Mental testing is an important example. Modern intelligence tests were developed by the French psychologist Alfred Binet (1857–1911). His goal was to develop a test that would identify

schoolchildren in need of educational support. His test, which included tasks of reasoning and problem solving, was introduced in the United States by Henry Goddard (1866–1957) and later standardized by Lewis Terman (1877–1956) at Stanford University. The assessment and meaning of intelligence has fueled debates in American psychology and society for nearly 100 years. Much of this is captured in the nature-nurture debate that raises questions about the relative contributions

of heredity and environment in determining intelligence (**Fancher, 1987**).

Applied psychology was not limited to mental testing. What psychologists were learning in their laboratories was applied in many settings including the military, business, industry, and education. The early 20th century was witness to rapid advances in applied psychology. Hugo Munsterberg (1863–1916) of Harvard University made contributions to such areas as employee selection, eyewitness testimony, and psychotherapy. Walter D. Scott (1869–1955) and Harry Hollingworth (1880–1956) produced original work on the psychology of advertising and marketing. Lillian Gilbreth (1878–1972) was a pioneer in industrial psychology and engineering psychology. Working with her husband, Frank, they promoted the use of time and motion studies to improve efficiency in industry. Lillian also brought the efficiency movement to the home, designing kitchens and appliances including the pop-up trashcan and refrigerator door shelving. Their psychology of efficiency also found plenty of applications at home with their 12 children. The experience served as the inspiration for the movie *Cheaper by the Dozen* (**Benjamin, 2007**).

Clinical psychology was also an early application of experimental psychology in America. Lightner Witmer (1867–1956) received his Ph.D. in experimental psychology with Wilhelm Wundt and returned to the University of Pennsylvania, where he opened a psychological clinic in 1896. Witmer believed that because psychology dealt with the study of sensation and perception, it should be of value in treating children with learning and behavioral problems. He is credited as the founder of both clinical and school psychology (**Benjamin & Baker, 2004**).

Psychology as a Profession



Although this is what most people see in their mind's eye when asked to envision a "psychologist" the APA recognizes as many as 58 different divisions of psychology.

[Image: Bliusa, <https://goo.gl/yrSUCr>, CC BY-SA 4.0, <https://goo.gl/6pvNbx>]

As the roles of psychologists and the needs of the public continued to change, it was necessary for psychology to begin to define itself as a profession. Without standards for training and practice, anyone could use the title psychologist and offer services to the public. As early as 1917, applied psychologists organized to create standards for education, training, and licensure. By the 1930s, these

efforts led to the creation of the American Association for Applied Psychology (AAAP). While the American Psychological Association (APA) represented the interests of academic psychologists, AAAP served those in education, industry, consulting, and clinical work.

The advent of WWII changed everything. The psychiatric casualties of war were staggering, and there were simply not enough mental health professionals to meet the need. Recognizing the shortage, the federal government urged the AAAP and APA to work together to meet the mental health needs of the nation. The result was the merging of the AAAP and the APA and a focus on the training of professional psychologists. Through the provisions of National Mental Health Act of 1946, funding was made available that allowed the APA, the Veterans Administration, and the Public Health Service to work together to develop training programs that would produce clinical psychologists. These efforts led to the

convening of the Boulder Conference on Graduate Education in Clinical Psychology in 1949 in Boulder, Colorado. The meeting launched doctoral training in psychology and gave us the **scientist-practitioner model** of training. Similar meetings also helped launch doctoral training programs in counseling and school psychology. Throughout the second half of the 20th century, alternatives to Boulder have been debated. In 1973, the Vail Conference on Professional Training in Psychology proposed the **scholar-practitioner model** and the Psy.D. degree (Doctor of Psychology). It is a training model that emphasizes clinical training and practice that has become more common (Cautin & Baker, 2014).

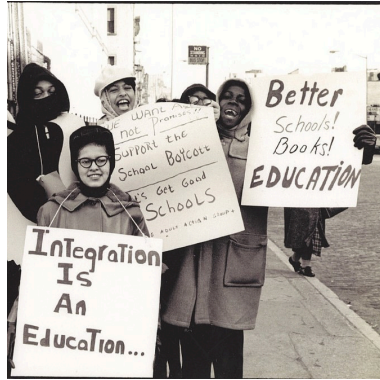
Psychology and Society

Given that psychology deals with the human condition, it is not surprising that psychologists would involve themselves in social issues. For more than a century, psychology and psychologists have been agents of social action and change. Using the methods and tools of science, psychologists have challenged assumptions, stereotypes, and stigma. Founded in 1936, the Society for the Psychological Study of Social Issues (SPSSI) has supported research and action on a wide range of social issues. Individually, there have been many psychologists whose efforts have promoted social change. Helen Thompson Woolley (1874–1947) and Leta

S. Hollingworth (1886–1939) were pioneers in research on the psychology of sex differences. Working in the early 20th century, when women's rights were marginalized, Thompson examined the assumption that women were overemotional compared to men and found that emotion did not influence women's decisions any more than it did men's. Hollingworth found that menstruation did not negatively impact women's cognitive or motor abilities. Such work combatted harmful

stereotypes and showed that psychological research could contribute to social change (**Scarborough & Furumoto, 1987**).

Among the first generation of African American psychologists, Mamie Phipps Clark (1917–1983) and her husband Kenneth Clark (1914–2005) studied the psychology of race and demonstrated the ways in which school segregation negatively impacted the self-esteem of African American



children. Their research was influential in the 1954 Supreme Court ruling in the case of *Brown v. Board of Education*, which ended school segregation (**Guthrie, 2003**). In psychology, greater advocacy for issues impacting the African American community were advanced by the creation of the Association of Black Psychologists (ABPsi) in 1968.

In 1957, psychologist Evelyn Hooker (1907–1996) published the paper “The Adjustment of the Male Overt Homosexual,” reporting on her research that showed no significant differences in psychological adjustment between homosexual and heterosexual men. Her research helped to de-pathologize homosexuality and contributed to the decision by the American Psychiatric Association to remove homosexuality from the Diagnostic and Statistical Manual of Mental Disorders in 1973 (**Garnets & Kimmel, 2003**).

Conclusion

Growth and expansion have been a constant in American psychology. In the latter part of the 20th century, areas such as social, developmental, and personality psychology made major

contributions to our understanding of what it means to be human. Today neuroscience is enjoying tremendous interest and growth.

As mentioned at the beginning of the module, it is a challenge to cover all the history of psychology in such a short space. Errors of omission and commission are likely in such a selective review. The history of psychology helps to set a stage upon which the story of psychology can be told. This brief summary provides some glimpse into the depth and rich content offered by the history of psychology. The learning modules in the PSYC 100 collection are all elaborations on the foundation created by our shared past. It is hoped that you will be able to see these connections and have a greater understanding and appreciation for both the unity and diversity of the field of psychology.

Timeline

1600s – Rise of empiricism emphasizing centrality of human observer in acquiring knowledge
1850s – Helmholtz measures neural impulse / Psychophysics studied by Weber & Fechner
1859 – Publication of Darwin's *Origin of Species*

1879 – Wundt opens lab for experimental psychology
1883 – First psychology lab opens in the United States

1887 – First American psychology journal is published: *American Journal of Psychology*

1890 – James publishes *Principles of Psychology*

1892 – APA established

1894 – Margaret Floy Washburn is first U.S. woman to earn Ph.D. in psychology
1904 – Founding of Titchener's experimentalists

1905 – Mary Whiton Calkins is first woman president of APA
1909 – Freud's only visit to the United States

1913 – John Watson calls for a psychology of behavior

1920 – Francis Cecil Sumner is first African American to earn Ph.D. in psychology

1921 – Margaret Floy Washburn is second woman president of APA

1930s – Creation and growth of the American Association for Applied Psychology (AAAP) / Gestalt psychology comes to America

1936 – Founding of The Society for the Psychological Study of Social Issues 1940s – Behaviorism dominates American psychology

1946 – National Mental Health Act

1949 – Boulder Conference on Graduate Education in Clinical Psychology 1950s – Cognitive psychology gains popularity

1954 – *Brown v. Board of Education*

1957 – Evelyn Hooker publishes *The Adjustment of the Male Overt Homosexual*

1968 – Founding of the Association of Black Psychologists

1973 – Psy.D. proposed at the Vail Conference on Professional Training in Psychology

1988 – Founding of the American Psychological Society (now known as the Association for Psychological Science)

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Behaviorism

The study of behavior.

Cognitive psychology

The study of mental processes.

Consciousness

Awareness of ourselves and our environment.

Empiricism

The belief that knowledge comes from experience.

Eugenics

The practice of selective breeding to promote desired traits.

Flashbulb memory

A highly detailed and vivid memory of an emotionally significant event.

Functionalism

A school of American psychology that focused on the utility of consciousness.

Gestalt psychology

An attempt to study the unity of experience.

Individual differences

Ways in which people differ in terms of their behavior, emotion, cognition, and development.

Introspection

A method of focusing on internal processes.

Neural impulse

An electro-chemical signal that enables neurons to communicate.

Practitioner-Scholar Model

A model of training of professional psychologists that emphasizes clinical practice.

Psychophysics

Study of the relationships between physical stimuli and the perception of those stimuli.

Realism

A point of view that emphasizes the importance of the senses in providing knowledge of the external world.

Scientist-practitioner model

A model of training of professional psychologists that emphasizes the development of both research and clinical skills.

Structuralism

A school of American psychology that sought to describe the elements of conscious experience.

Tip-of-the-tongue phenomenon

The inability to pull a word from memory even though there is the sensation that that word is available.

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PSYC 100 II

RESEARCH METHODS

5. Statistical Thinking

Original chapter by Beth Chance and Allan Rossman adapted by the Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

As our society increasingly calls for evidence-based decision making, it is important to consider how and when we can draw valid inferences from data. This module will use four recent research studies to highlight key elements of a statistical investigation.

Learning Objectives

- Define basic elements of a statistical investigation.
- Describe the role of p-values and confidence intervals in statistical inference.
- Describe the role of random sampling in generalizing conclusions from a sample to a population.
- Describe the role of random assignment in drawing cause-and-effect conclusions.
- Critique statistical studies.

Introduction

Does drinking coffee actually increase your life expectancy? A recent study (**Freedman, Park, Abnet, Hollenbeck, & Sinha, 2012**) found that men who drank at least six cups of coffee a day had a 10% lower chance of dying (women 15% lower) than those who drank none. Does this mean you should pick up or increase your own coffee habit?

Modern society has become awash in studies such as this; you can read about several such studies in the news every day. Moreover, data abound everywhere in modern life. Conducting such a study well, and interpreting the results of such studies well for making informed decisions or setting policies, requires understanding basic ideas of statistics, the science of gaining insight from data. Rather than relying on anecdote and intuition, statistics allows us to systematically study phenomena of interest.



People around the world differ in their preferences for drinking coffee versus drinking tea. Would the results of the coffee study be the same in Canada as in China? [Image: Duncan, <https://goo.gl/vbMyTm>, CC BY-NC 2.0, <https://goo.gl/18UUGY>]

Key components to a statistical investigation are:

- **Planning the study:** Start by asking a testable research question and deciding how to collect data. For example, how long was the study period of the coffee study? How many people were recruited for the study, how were they recruited, and from where? How old were they? What other variables were recorded about the individuals, such as smoking habits, on the comprehensive lifestyle questionnaires? Were changes made to the participants' coffee habits during the course of the study?
- **Examining the data:** What are appropriate ways to

examine the data? What graphs are relevant, and what do they reveal? What descriptive statistics can be calculated to summarize relevant aspects of the data, and what do they reveal? What patterns do you see in the data? Are there any individual observations that deviate from the overall pattern, and what do they reveal? For example, in the coffee study, did the proportions differ when we compared the smokers to the non-smokers? Is there evidence for **reliability** and **validity**?

- **Inferring from the data:** What are valid statistical methods for drawing inferences “beyond” the data you collected? In the coffee study, is the 10%–15% reduction in risk of death something that could have happened just by chance?
- **Drawing conclusions:** Based on what you learned from your data, what conclusions can you draw? Who do you think these conclusions apply to? (Were the people in the coffee study older? Healthy? Living in cities?) Can you draw a **cause-and-effect** conclusion about your treatments? (Are scientists now saying that the coffee drinking is the cause of the decreased risk of death?)

Notice that the numerical analysis (“crunching numbers” on the computer) comprises only a small part of overall statistical investigation. In this module, you will see how we can answer some of these questions and what questions you should be asking about any statistical investigation you read about.

Distributional Thinking

When data are collected to address a particular question, an important first step is to think of meaningful ways to organize and examine the data. The most fundamental principle of statistics is that data vary. The pattern of that variation is crucial

to capture and to understand. Often, careful presentation of the data will address many of the research questions without requiring more sophisticated analyses. It may, however, point to additional questions that need to be examined in more detail.

Example 1: Researchers investigated whether cancer pamphlets are written at an appropriate level to be read and understood by cancer patients (Short, Moriarty, & Cooley, 1995). Tests of reading ability were given to 63 patients. In addition, readability level was determined for a sample of 30 pamphlets, based on characteristics such as the lengths of words and sentences in the pamphlet. The results, reported in terms of grade levels, are displayed in Table 1.

Patients' reading levels	<3	3	4	5	6	7	8	9	10	11	12	>12	Total
Count (number of patients)	6	4	4	3	3	2	6	5	4	7	2	17	63

Pamphlet's readability levels	6	7	8	9	10	11	12	13	14	15	16	Total
Count (number of pamphlets)	3	3	8	4	1	1	4	2	1	2	1	30

Table 1. Frequency tables of patient reading levels and pamphlet readability levels.

These two variables reveal two fundamental aspects of statistical thinking:

- Data vary. More specifically, values of a variable (such as reading level of a cancer patient or readability level of a cancer pamphlet) vary.
- Analyzing the pattern of variation, called the **distribution** of the variable, often reveals insights.

Addressing the research question of whether the cancer pamphlets are written at appropriate levels for the cancer patients requires comparing the two distributions. A naïve comparison might focus only on the centers of the

distributions. Both medians turn out to be ninth grade, but considering only medians ignores the variability and the overall distributions of these data. A more illuminating approach is to compare the entire distributions, for example with a graph, as in Figure 1.

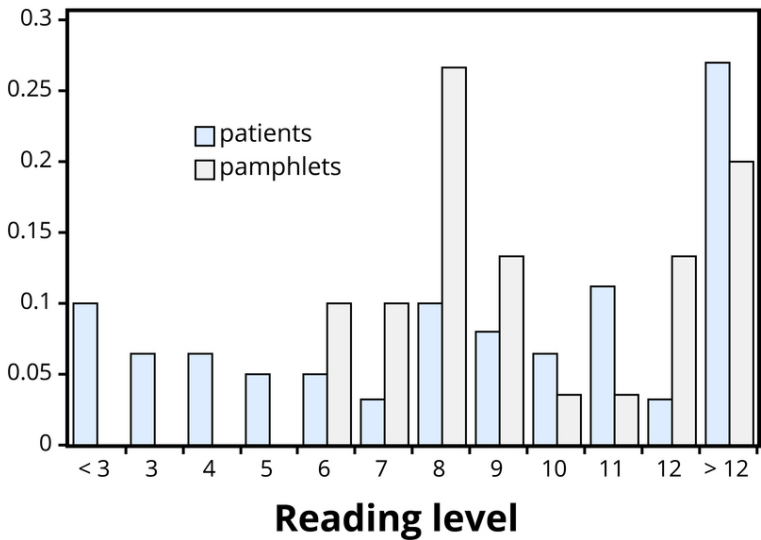


Figure 1: Comparison of patient reading levels and pamphlet readability levels.

Figure 1 makes clear that the two distributions are not well aligned at all. The most glaring discrepancy is that many patients (17/63, or 27%, to be precise) have a reading level below that of the most readable pamphlet. These patients will need help to understand the information provided in the cancer pamphlets. Notice that this conclusion follows from considering the distributions as a whole, not simply measures of center or variability, and that the graph contrasts those distributions more immediately than the frequency tables.

Statistical Significance

Even when we find patterns in data, often there is still uncertainty in various aspects of the data. For example, there may be potential for measurement errors (even your own body temperature can fluctuate by almost 1 °F over the course of the day). Or we may only have a “snapshot” of observations from a more long-term process or only a small subset of individuals from the population of interest. In such cases, how can we determine whether patterns we see in our small set of data is convincing evidence of a systematic phenomenon in the larger process or population?

Example 2: In a study reported in the November 2007 issue of *Nature*, researchers investigated whether pre-verbal infants take into account an individual's actions toward others in evaluating that individual as appealing or aversive (**Hamlin, Wynn, & Bloom, 2007**). In one component of the study, 10-month-old infants were shown a “climber” character (a piece of wood with “googly” eyes glued onto it) that could not make it up a hill in two tries. Then the infants were shown two scenarios for the climber's next try, one where the climber was pushed to the top of the hill by another character (“helper”), and one where the climber was pushed back down the hill by another character (“hinderer”). The infant was alternately shown these two scenarios several times. Then the infant was presented with two pieces of wood (representing the helper and the hinderer characters) and asked to pick one to play with. The researchers found that of the 16 infants who made a clear choice, 14 chose to play with the helper toy.



Correlation does not equal causation: When babies get their first teeth their saliva production increases but this does not mean that increased saliva causes them to get their teeth. [Image: Ben McLeod, <https://goo.gl/0EkXpV>, CC BY-NC-SA 2.0, <https://goo.gl/TocOZF>]

One possible explanation for this clear majority result is that the helping behavior of the one toy increases the infants' likelihood of choosing that toy. But are there other possible explanations? What about the color of the toy? Well, prior to collecting the data, the researchers arranged so that each color and shape (red square and blue circle) would be seen by the same number of infants. Or maybe the infants had right-handed tendencies and so picked whichever toy was closer to

their right hand? Well, prior to collecting the data, the researchers arranged it so half the infants saw the helper toy on the right and half on the left. Or, maybe the shapes of these wooden characters (square, triangle, circle) had an effect? Perhaps, but again, the researchers controlled for this by rotating which shape was the helper toy, the hinderer toy, and the climber. When designing experiments, it is important to *control* for as many variables as might affect the responses as possible.

It is beginning to appear that the researchers accounted for all the other plausible explanations. But there is one more important consideration that cannot be controlled—if we did the study again with these 16 infants, they might not make the same choices. In other words, there is some *randomness* inherent in their selection process. Maybe each infant had no genuine preference at all, and it was simply “random luck” that led to 14 infants picking the helper toy. Although this random

component cannot be controlled, we can apply a *probability model* to investigate the pattern of results that would occur in the long run if random chance were the only factor.

If the infants were equally likely to pick between the two toys, then each infant had a 50% chance of picking the helper toy. It's like each infant tossed a coin, and if it landed heads, the infant picked the helper toy. So if we tossed a coin 16 times, could it land heads 14 times? Sure, it's possible, but it turns out to be very unlikely. Getting 14 (or more) heads in 16 tosses is about as likely as tossing a coin and getting 9 heads in a row. This probability is referred to as a **p-value**. The p-value tells you how often a random process would give a result at least as extreme as what was found in the actual study, assuming there was nothing other than random chance at play. So, if we assume that each infant was choosing equally, then the probability that 14 or more out of 16 infants would choose the helper toy is found to be 0.0021. We have only two logical possibilities: either the infants have a genuine preference for the helper toy, or the infants have no preference (50/50) and an outcome that would occur only 2 times in 1,000 iterations happened in this study. Because this p-value of 0.0021 is quite small, we conclude that the study provides very strong evidence that these infants have a genuine preference for the helper toy. We often compare the p-value to some cut-off value (called the level of **significance**, typically around 0.05). If the p-value is smaller than that cut-off value, then we reject the hypothesis that only random chance was at play here. In this case, these researchers would conclude that *significantly* more than half of the infants in the study chose the helper toy, giving strong evidence of a genuine preference for the toy with the helping behavior.

Generalizability

One limitation to the previous study is that the conclusion only applies to the 16 infants in the study. We don't know much about how those 16 infants were selected. Suppose we want to select a subset of individuals (a **sample**) from a much larger group of individuals (the **population**) in such a way that conclusions from the sample can be **generalized** to the larger population. This is the question faced by pollsters every day.



Generalizability is an important research consideration: The results of studies with widely representative samples are more likely to generalize to the population. [Image: Mike PD, <https://goo.gl/ynFCMC>, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

Example 3: The General Social Survey (GSS) is a survey on societal trends conducted every other year in the United States. Based on a sample of about 2,000 adult Americans, researchers make claims about what percentage of the U.S. population consider themselves to be “liberal,” what percentage consider themselves “happy,” what percentage feel “rushed” in their daily lives, and many other issues. The key to making these claims about the larger population of all American adults lies in how the sample is selected. The goal is to select a sample that is representative of the population, and a common way to achieve this goal is to select a **random sample** that gives every member of the population an equal chance of being selected for the sample. In its simplest form, random sampling involves numbering every member of the population and then using a computer to randomly select the subset to be surveyed. Most polls don't

operate exactly like this, but they do use probability-based sampling methods to select individuals from nationally representative panels.

In 2004, the GSS reported that 817 of 977 respondents (or 83.6%) indicated that they always or sometimes feel rushed. This is a clear majority, but we again need to consider variation due to *random sampling*. Fortunately, we can use the same probability model we did in the previous example to investigate the probable size of this error. (Note, we can use the coin-tossing model when the actual population size is much, much larger than the sample size, as then we can still consider the probability to be the same for every individual in the sample.) This probability model predicts that the sample result will be within 3 percentage points of the population value (roughly 1 over the square root of the sample size, the **margin of error**). A statistician would conclude, with 95% confidence, that between 80.6% and 86.6% of all adult Americans in 2004 would have responded that they sometimes or always feel rushed.

The key to the margin of error is that when we use a probability sampling method, we can make claims about how often (in the long run, with repeated random sampling) the sample result would fall within a certain distance from the unknown population value by chance (meaning by random sampling variation) alone. Conversely, non-random samples are often suspect to bias, meaning the sampling method systematically over-represents some segments of the population and under-represents others. We also still need to consider other sources of bias, such as individuals not responding honestly. These sources of error are not measured by the margin of error.

Cause and Effect Conclusions

In many research studies, the primary question of interest

concerns differences between groups. Then the question becomes how were the groups formed (e.g., selecting people who already drink coffee vs. those who don't). In some studies, the researchers actively form the groups themselves. But then we have a similar question—could any differences we observe in the groups be an artifact of that group-formation process? Or maybe the difference we observe in the groups is so large that we can discount a “fluke” in the group-formation process as a reasonable explanation for what we find?

Example 4: A psychology study investigated whether people tend to display more creativity when they are thinking about intrinsic or extrinsic motivations (**Ramsey & Schafer, 2002**, based on a study by **Amabile, 1985**). The subjects were 47 people with extensive experience with creative writing. Subjects began by answering survey questions about either intrinsic motivations for writing (such as the pleasure of self-expression) or extrinsic motivations (such as public recognition). Then all subjects were instructed to write a haiku, and those poems were evaluated for creativity by a panel of judges. The researchers conjectured beforehand that subjects who were thinking about intrinsic motivations would display more creativity than subjects who were thinking about extrinsic motivations. The creativity scores from the 47 subjects in this study are displayed in Figure 2, where higher scores indicate more creativity.

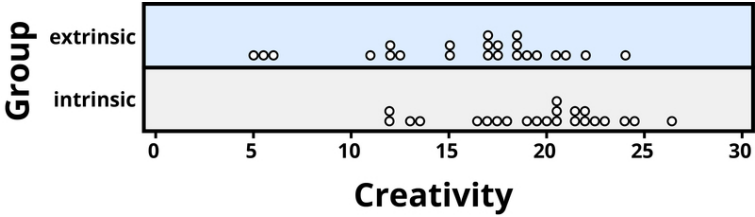


Figure 2. Creativity scores separated by type of motivation.

In this example, the key question is whether the type of motivation *affects* creativity scores. In particular, do subjects who were asked about intrinsic motivations tend to have higher creativity scores than subjects who were asked about extrinsic motivations?

Figure 2 reveals that both motivation groups saw considerable variability in creativity scores, and these scores have considerable overlap between the groups. In other words, it's certainly not always the case that those with extrinsic motivations have higher creativity than those with intrinsic motivations, but there may still be a statistical *tendency* in this direction. (Psychologist Keith Stanovich (2013) refers to people's difficulties with thinking about such probabilistic tendencies as "the Achilles heel of human cognition.")

The mean creativity score is 19.88 for the intrinsic group, compared to 15.74 for the extrinsic group, which supports the researchers' conjecture. Yet comparing only the means of the two groups fails to consider the variability of creativity scores in the groups. We can measure variability with statistics using, for instance, the standard deviation: 5.25 for the extrinsic group and 4.40 for the intrinsic group. The standard deviations tell us that most of the creativity scores are within about 5 points of the mean score in each group. We see that the mean score for the intrinsic group lies within one standard deviation of the mean score for extrinsic group. So, although there is a tendency for the creativity scores to be higher in the intrinsic group, on average, the difference is not extremely large.

We again want to consider possible explanations for this difference. The study only involved individuals with extensive creative writing experience. Although this limits the population to which we can generalize, it does not explain why the mean creativity score was a bit larger for the intrinsic group than for the extrinsic group. Maybe women tend to receive higher creativity scores? Here is where we need to focus on how the individuals were assigned to the motivation groups. If only

women were in the intrinsic motivation group and only men in the extrinsic group, then this would present a problem because we wouldn't know if the intrinsic group did better because of the different type of motivation or because they were women. However, the researchers guarded against such a problem by **randomly assigning** the individuals to the motivation groups. Like flipping a coin, each individual was just as likely to be assigned to either type of motivation. Why is this helpful? Because this random assignment tends to balance out all the variables related to creativity we can think of, and even those we don't think of in advance, between the two groups. So we should have a similar male/female split between the two groups; we should have a similar age distribution between the two groups; we should have a similar distribution of educational background between the two groups; and so on. Random assignment should produce groups that are as similar as possible except for the type of motivation, which presumably eliminates all those other variables as possible explanations for the observed tendency for higher scores in the intrinsic group.

But does this always work? No, so by “luck of the draw” the groups may be a little different prior to answering the motivation survey. So then the question is, is it possible that an unlucky random assignment is responsible for the observed difference in creativity scores between the groups? In other words, suppose each individual's poem was going to get the same creativity score no matter which group they were assigned to, that the type of motivation in no way impacted their score. Then how often would the random-assignment process alone lead to a difference in mean creativity scores as large (or larger) than $19.88 - 15.74 = 4.14$ points?

We again want to apply to a probability model to approximate a p-value, but this time the model will be a bit different. Think of writing everyone's creativity scores on an index card, shuffling up the index cards, and then dealing out

23 to the extrinsic motivation group and 24 to the intrinsic motivation group, and finding the difference in the group means. We (better yet, the computer) can repeat this process over and over to see how often, when the scores don't change, random assignment leads to a difference in means at least as large as 4.41. Figure 3 shows the results from 1,000 such hypothetical random assignments for these scores.

Only 2 of the 1,000 simulated random assignments produced a difference in group means of 4.41 or larger. In other words, the approximate p-value is $2/1000 = 0.002$. This small p-value indicates that it would be very surprising for the random assignment process alone to produce such a large difference in group means. Therefore, as with Example 2, we have strong evidence that

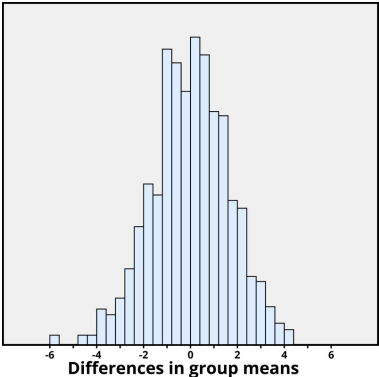


Figure 3. Differences in group means under random assignment alone.

focusing on intrinsic motivations tends to increase creativity scores, as compared to thinking about extrinsic motivations.

Notice that the previous statement implies a cause-and-effect relationship between motivation and creativity score; is such a strong conclusion justified? Yes, because of the random assignment used in the study. That should have balanced out any other variables between the two groups, so now that the small p-value convinces us that the higher mean in the intrinsic group wasn't just a coincidence, the only reasonable explanation left is the difference in the type of motivation. Can we generalize this conclusion to everyone? Not necessarily—we could cautiously generalize this conclusion to individuals with extensive experience in creative writing similar the individuals

in this study, but we would still want to know more about how these individuals were selected to participate.

The Importance of Diversity in Psychological Science

It is critically important that we carefully consider the extent to which our samples are truly diverse and random, the possibilities for alternative explanations for our results, and the degree to which our findings may (or may not) be generalizable. For example, historically, psychological science (and in science more broadly), has commonly used dichotomous categories of “men” and “women” to compare and contrast patterns of results. It is not always clear the degree to which these dichotomous terms have assessed sex, gender, or both. Further, this dichotomy of “men” and “women” (“male and “female,” etc.) fails to include many people who may not identify in a binary manner. Thus, it could be that there are limitations with interpretation of some of these findings. The topic of sex and gender can be considered as a lens for research, but also as its own major topic area in Psychology. For this reason, we will cover the topic of sex and gender in detail in our unit related to self and identity. We want to highlight this topic for your consideration here, and also link you to that chapter now if you would like to consider it in more detail earlier in our content.

Just as considering diversity related to sex and gender is important, so is considering diversity more broadly. For example, factors including (but not limited to) race, age, geographic location, socioeconomic status, and more, can have important influences on many research questions. We will highlight the need for diversity and inclusion in psychological science throughout our course, and encourage you to

continually question the degree to which our science can be more inclusive and diverse.

Conclusion



Researchers employ the scientific method that involves a great deal of statistical thinking: generate a hypothesis → design a study to test that hypothesis → conduct the study → analyze the data → report the results. [Image: widdowquinn, <https://goo.gl/9l8Dht>, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

Statistical thinking involves the careful design of a study to collect meaningful data to answer a focused research question, detailed analysis of patterns in the data, and drawing conclusions that go beyond the observed data. Random sampling is paramount to generalizing results from our sample to a larger population, and random assignment is key to drawing cause-and-effect conclusions. With both kinds of randomness, probability models help us assess how much random variation we can expect in our results, in

order to determine whether our results could happen by chance alone and to estimate a margin of error.

So where does this leave us with regard to the coffee study mentioned at the beginning of this module? We can answer many of the questions:

- This was a 14-year study conducted by researchers at the National Cancer Institute.
- The results were published in the June issue of the *New England Journal of Medicine*, a respected, peer-reviewed

journal.

- The study reviewed coffee habits of more than 402,000 people ages 50 to 71 from six states and two metropolitan areas. Those with cancer, heart disease, and stroke were excluded at the start of the study. Coffee consumption was assessed once at the start of the study.
- About 52,000 people died during the course of the study.
- People who drank between two and five cups of coffee daily showed a lower risk as well, but the amount of reduction increased for those drinking six or more cups.
- The sample sizes were fairly large and so the p-values are quite small, even though percent reduction in risk was not extremely large (dropping from a 12% chance to about 10%–11%).
- Whether coffee was caffeinated or decaffeinated did not appear to affect the results.
- This was an observational study, so no cause-and-effect conclusions can be drawn between coffee drinking and increased longevity, contrary to the impression conveyed by many news headlines about this study. In particular, it's possible that those with chronic diseases don't tend to drink coffee.

This study needs to be reviewed in the larger context of similar studies and consistency of results across studies, with the constant caution that this was not a randomized experiment. Whereas a statistical analysis can still “adjust” for other potential confounding variables, we are not yet convinced that researchers have identified them all or completely isolated why this decrease in death risk is evident. Researchers can now take the findings of this study and develop more focused studies that address new questions.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Cause-and-effect

Related to whether we say one variable is causing changes in the other variable, versus other variables that may be related to these two variables.

Confidence interval

An interval of plausible values for a population parameter; the interval of values within the margin of error of a statistic.

Distribution

The pattern of variation in data.

Generalizability

Related to whether the results from the sample can be

generalized to a larger population.

Margin of error

The expected amount of random variation in a statistic; often defined for 95% confidence level.

Parameter

A numerical result summarizing a population (e.g., mean, proportion).

Population

A larger collection of individuals that we would like to generalize our results to.

P-value

The probability of observing a particular outcome in a sample, or more extreme, under a conjecture about the larger population or process.

Random assignment

Using a probability-based method to divide a sample into treatment groups.

Random sampling

Using a probability-based method to select a subset of individuals for the sample from the population.

Reliability

The consistency of a measure.

Sample

The collection of individuals on which we collect data.

Statistic

A numerical result computed from a sample (e.g., mean, proportion).

Statistical significance

A result is statistically significant if it is unlikely to arise by chance alone.

Validity

The degree to which a measure is assessing what it is intended to measure.

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6. Conducting Psychology Research in the Real World

Original chapter by Matthias R. Mehl
adapted by the Queen's University
Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen’s Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

Because of its ability to determine cause-and-effect relationships, the laboratory experiment is traditionally considered the method of choice for psychological science. One downside, however, is that as it carefully controls conditions and their effects, it can yield findings that are out of touch with reality and have limited use when trying to understand real-world behavior. This module highlights the importance of also conducting research outside the psychology laboratory, within participants’ natural, everyday environments, and reviews existing methodologies for studying daily life

Learning Objectives

- Identify limitations of the traditional laboratory experiment.
- Explain ways in which daily life research can further psychological science.
- Know what methods exist for conducting psychological research in the real world.

Introduction

Psychology can be applied in *many* ways, leading to many different career paths. Before we begin to introduce you to some of the many ways that psychology, and psychology research can be applied, it may be helpful to think about *careers* that can open to you as a result of studying psychology. The following video explores pathways for both learning about, and pursuing career options, related to psychology.



An interactive H5P element has been excluded from this version of the text. You can view it online

here:

<https://ecampusontario.pressbooks.pub/testbookje/?p=392#h5p-364>

Applying Psychological Science

The laboratory experiment is traditionally considered the “gold standard” in psychology research. This is because only

laboratory experiments can clearly separate cause from effect and therefore establish causality. Despite this unique strength, it is also clear that a scientific field that is mainly based on controlled laboratory studies ends up lopsided. Specifically, it accumulates a lot of knowledge on what *can* happen—under carefully isolated and controlled circumstances—but it has little to say about what actually *does* happen under the circumstances that people actually encounter in their daily lives.



Do the research results obtained in isolated, carefully controlled laboratory conditions generalize into the real world? [Image: Nessen Marshall, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

For example, imagine you are a participant in an experiment that looks at the effect of being in a good mood on generosity, a topic that may have a good deal of practical application. Researchers create an internally-valid, carefully-controlled experiment where they randomly assign you to watch either a happy movie or a neutral movie, and then you are given the opportunity to help the researcher out by staying

longer and participating in another study. If people in a good mood are more willing to stay and help out, the researchers can feel confident that – since everything else was held constant – your positive mood led you to be more helpful. However, what does this tell us about helping behaviors in the real world? Does it **generalize** to other kinds of helping, such as donating money to a charitable cause? Would all kinds of happy movies produce this behavior, or only this one? What about other positive experiences that might boost mood, like receiving a compliment or a good grade? And what if you were

watching the movie with friends, in a crowded theatre, rather than in a sterile research lab? Taking research out into the real world can help answer some of these sorts of important questions.

As one of the founding fathers of social psychology remarked, “Experimentation in the laboratory occurs, socially speaking, on an island quite isolated from the life of society” (**Lewin, 1944**, p. 286). This module highlights the importance of going beyond experimentation and also conducting research outside the laboratory (**Reis & Gosling, 2010**), directly within participants’ natural environments, and reviews existing methodologies for studying daily life.

Rationale for Conducting Psychology Research in the Real World

One important challenge researchers face when designing a study is to find the right balance between ensuring **Internal Validity**, or the degree to which a study allows unambiguous causal inferences, and **External Validity**, or the degree to which a study ensures that potential findings apply to settings and samples other than the ones being studied (**Brewer, 2000**). Unfortunately, these two kinds of validity tend to be difficult to achieve at the same time, in one study. This is because creating a controlled setting, in which all potentially influential factors (other than the experimentally-manipulated variable) are controlled, is bound to create an environment that is quite different from what people naturally encounter (e.g., using a happy movie clip to promote helpful behavior). However, it is the degree to which an experimental situation is comparable to the corresponding real-world situation of interest that determines how generalizable potential findings will be. In other words, if an experiment is very far-off from what a person

might normally experience in everyday life, you might reasonably question just how useful its findings are.

Because of the incompatibility of the two types of validity, one is often—by design—prioritized over the other. Due to the importance of identifying true causal relationships, psychology has traditionally emphasized internal over external validity. However, in order to make claims about human behavior that apply across populations and environments, researchers complement traditional laboratory research, where participants are brought into the lab, with field research where, in essence, the psychological laboratory is brought to participants. Field studies allow for the important test of how psychological variables and processes of interest “behave” under real-world circumstances (i.e., what *actually does happen* rather than what *can happen*). They can also facilitate “downstream” operationalizations of constructs that measure life outcomes of interest *directly* rather than indirectly.

Take, for example, the fascinating field of psychoneuroimmunology, where the goal is to understand the interplay of psychological factors – such as personality traits or one’s stress level – and the immune system. Highly sophisticated and carefully controlled experiments offer ways to isolate the variety of neural, hormonal, and cellular mechanisms that link psychological variables such as chronic stress to biological outcomes such as immunosuppression (a state of impaired immune functioning; **Sapolsky, 2004**). Although these studies demonstrate impressively how psychological factors can affect health-relevant biological processes, they—because of their research design—remain mute about the degree to which these factors actually do undermine people’s everyday health in real life. It is certainly important to show that laboratory stress can alter the number of natural killer cells in the blood. But it is equally important to test to what extent the levels of stress that people experience on a day-to-day basis result in them catching a cold more often

or taking longer to recover from one. The goal for researchers, therefore, must be to complement traditional laboratory experiments with less controlled studies under real-world circumstances. The term **ecological validity** is used to refer the degree to which an effect has been obtained under conditions that are typical for what happens in everyday life (**Brewer, 2000**). In this example, then, people might keep a careful daily log of how much stress they are under as well as noting physical symptoms such as headaches or nausea. Although many factors beyond stress level may be responsible for these symptoms, this more correlational approach can shed light on how the relationship between stress and health plays out outside of the laboratory.

An Overview of Research Methods for Studying Daily Life

Capturing “life as it is lived” has been a strong goal for some researchers for a long time. Wilhelm and his colleagues recently published a comprehensive review of early attempts to systematically document daily life (**Wilhelm, Perrez, & Pawlik, 2012**). Building onto these original methods, researchers have, over the past decades, developed a broad toolbox for measuring experiences, behavior, and physiology directly in participants’ daily lives (**Mehl & Conner, 2012**). Figure 1 provides a schematic overview of the methodologies described below.

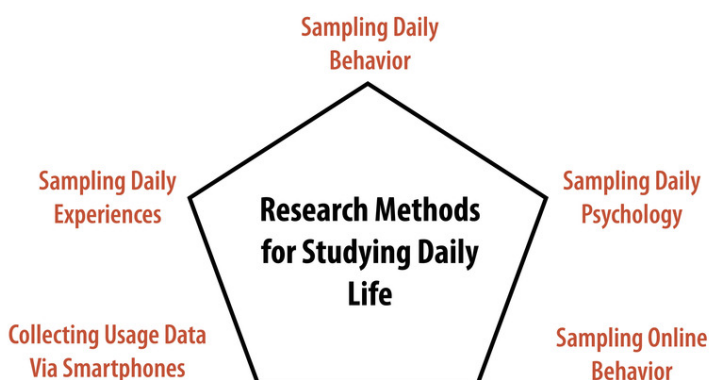


Figure 1. Schematic Overview of Research Methods for Studying Daily Life

Studying Daily Experiences

Starting in the mid-1970s, motivated by a growing skepticism toward highly-controlled laboratory studies, a few groups of researchers developed a set of new methods that are now commonly known as the **experience-sampling method** (Hektner, Schmidt, & Csikszentmihalyi, 2007), **ecological momentary assessment** (Stone & Shiffman, 1994), or the **diary method** (Bolger & Rafaeli, 2003). Although variations within this set of methods exist, the basic idea behind all of them is to collect in-the-moment (or, close-to-the-moment) self-report data directly from people as they go about their daily lives. This is typically accomplished by asking participants' repeatedly (e.g., five times per day) over a period of time (e.g., a week) to report on their current thoughts and feelings. The momentary questionnaires often ask about their location (e.g., "Where are you now?"), social environment (e.g., "With whom are you now?"), activity (e.g., "What are you currently doing?"), and experiences (e.g., "How are you feeling?"). That way, researchers

get a snapshot of what was going on in participants' lives at the time at which they were asked to report.

Technology has made this sort of research possible, and recent technological advances have altered the different tools researchers are able to easily use. Initially, participants wore electronic wristwatches that beeped at preprogrammed but seemingly random times, at which they completed one of a stack of provided paper questionnaires. With the mobile computing revolution, both the prompting and the questionnaire completion were gradually replaced by handheld devices such as smartphones. Being able to collect the momentary questionnaires digitally and time-stamped (i.e., having a record of exactly when participants responded) had major methodological and practical advantages and contributed to experience sampling going mainstream (**Conner, Tennen, Fleeson, & Barrett, 2009**).

Over time, experience sampling and related momentary self-report methods have become very popular, and, by now, they are effectively the gold standard for studying daily life. They have helped make progress in almost all areas of psychology (**Mehl & Conner, 2012**). These methods ensure receiving many measurements from many participants, and has further inspired the development of novel statistical methods (**Bolger & Laurenceau, 2013**). Finally, and maybe most importantly, they



Using modern technology like smartphones allows for more widespread experience sampling of research participants. Whether at home, work, or just sitting in a coffee shop technology makes it easier than ever to participate in psychology research. [Image: Vladimir Yaitskiy, <https://goo.gl/7sjXfq>, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

accomplished what they sought out to accomplish: to bring attention to what psychology ultimately wants and needs to know about, namely “what people actually do, think, and feel in the various contexts of their lives” (**Funder, 2001**, p. 213). In short, these approaches have allowed researchers to do research that is more externally valid, or more generalizable to real life, than the traditional laboratory experiment.

To illustrate these techniques, consider a classic study, Stone, Reed, and Neale (**1987**), who tracked positive and negative experiences surrounding a respiratory infection using daily experience sampling. They found that undesirable experiences peaked and desirable ones dipped about four to five days prior to participants coming down with the cold. More recently, Killingsworth and Gilbert (**2010**) collected momentary self-reports from more than 2,000 participants via a smartphone app. They found that participants were less happy when their mind was in an idling, mind-wandering state, such as surfing the Internet or multitasking at work, than when it was in an engaged, task-focused one, such as working diligently on a paper. These are just two examples that illustrate how experience-sampling studies have yielded findings that could not be obtained with traditional laboratory methods.

Recently, the **day reconstruction method (DRM)** (**Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004**) has been developed to obtain information about a person’s daily experiences without going through the burden of collecting momentary experience-sampling data. In the DRM, participants report their experiences of a given day retrospectively after engaging in a systematic, experiential reconstruction of the day on the following day. As a participant in this type of study, you might look back on yesterday, divide it up into a series of episodes such as “made breakfast,” “drove to work,” “had a meeting,” etc. You might then report who you were with in each episode and how you felt in each. This approach has shed light on what situations lead to moments of

positive and negative mood throughout the course of a normal day.

Studying Daily Behavior

Experience sampling is often used to study everyday behavior (i.e., daily social interactions and activities). In the laboratory, behavior is best studied using direct behavioral observation (e.g., video recordings). In the real world, this is, of course, much more difficult. As Funder put it, it seems it would require a “detective’s report [that] would specify in exact detail everything the participant said and did, and with whom, in all of the contexts of the participant’s life” (**Funder, 2007**, p. 41).

As difficult as this may seem, Mehl and colleagues have developed a naturalistic observation methodology that is similar in spirit. Rather than following participants—like a detective—with a video camera (see **Craik, 2000**), they equip participants with a portable audio recorder that is programmed to periodically record brief snippets of ambient sounds (e.g., 30 seconds every 12 minutes). Participants carry the recorder (originally a microcassette recorder, now a smartphone app) on them as they go about their days and return it at the end of the study. The recorder provides researchers with a series of sound bites that, together, amount to an acoustic diary of participants’ days as they naturally unfold—and that constitute a representative sample of their daily activities and social encounters. Because it is somewhat similar to having the researcher’s ear at the participant’s lapel, they called their method the **electronically activated recorder, or EAR** (**Mehl, Pennebaker, Crow, Dabbs, & Price, 2001**). The ambient sound recordings can be coded for many things, including participants’ locations (e.g., at school, in a coffee shop), activities (e.g., watching TV, eating), interactions (e.g., in a group, on the phone), and emotional expressions (e.g.,

laughing, sighing). As unnatural or intrusive as it might seem, participants report that they quickly grow accustomed to the EAR and say they soon find themselves behaving as they normally would.

In a cross-cultural study, Ramírez-Esparza and her colleagues used the EAR method to study sociability in the United States and Mexico. Interestingly, they found that although American participants rated themselves significantly higher than Mexicans on the question, “I see myself as a person who is talkative,” they actually spent almost 10 percent less time talking than Mexicans did (**Ramírez-Esparza, Mehl, Álvarez Bermúdez, & Pennebaker, 2009**). In a similar way, Mehl and his colleagues used the EAR method to debunk the long-standing myth that women are considerably more talkative than men. Using data from six different studies, they showed that both sexes use on average about 16,000 words per day. The estimated sex difference of 546 words was trivial compared to the immense range of more than 46,000 words between the least and most talkative individual (695 versus 47,016 words; **Mehl, Vazire, Ramírez-Esparza, Slatcher, & Pennebaker, 2007**). Together, these studies demonstrate how naturalistic observation can be used to study objective aspects of daily behavior and how it can yield findings quite different from what other methods yield (**Mehl, Robbins, & Deters, 2012**).

A series of other methods and creative ways for assessing behavior directly and unobtrusively in the real world are described in a seminal book on real-world, subtle measures (**Webb, Campbell, Schwartz, Sechrest, & Grove, 1981**). For example, researchers have used time-lapse photography to study the flow of people and the use of space in urban public places (**Whyte, 1980**). More recently, they have observed people's personal (e.g., dorm rooms) and professional (e.g., offices) spaces to understand how personality is expressed and detected in everyday environments (**Gosling, Ko, Mannarelli, & Morris, 2002**). They have even systematically collected and

analyzed people's garbage to measure what people actually consume (e.g., empty alcohol bottles or cigarette boxes) rather than what they *say* they consume (**Rathje & Murphy, 2001**). Because people often cannot and sometimes may not want to accurately report what they do, the direct—and ideally nonreactive—assessment of real-world behavior is of high importance for psychological research (**Baumeister, Vohs, & Funder, 2007**).

Studying Daily Physiology

In addition to studying how people think, feel, and behave in the real world, researchers are also interested in how our bodies respond to the fluctuating demands of our lives. What are the daily experiences that make our “blood boil”? How do our neurotransmitters and hormones respond to the stressors we encounter in our lives? What physiological reactions do we show to being loved—or getting ostracized? You can see how studying these powerful experiences in real life, as they actually happen, may provide more rich and informative data than one might obtain in an artificial laboratory setting that merely mimics these experiences.



Real world stressors may result in very different physiological responses than the same stressors simulated in a lab environment.
[Image: State Farm, <https://goo.gl/FGYyVz>, CC BY 2.0, <https://goo.gl/9uSnqN>]

Also, in pursuing these questions, it is important to keep in mind that what is stressful, engaging, or boring for one person might not be so for another. It is, in part, for this reason that researchers have found only limited correspondence between how people respond physiologically to a standardized laboratory stressor (e.g., giving a speech) and how they respond to stressful experiences in their lives. To give an example, Wilhelm and Grossman

(2010) describe a participant who showed rather minimal heart rate increases in response to a laboratory stressor (about five to 10 beats per minute) but quite dramatic increases (almost 50 beats per minute) later in the afternoon while watching a soccer game. Of course, the reverse pattern can happen as well, such as when patients have high blood pressure in the doctor's office but not in their home environment—the so-called **white coat hypertension** (White, Schulman, McCabe, & Dey, 1989).

Ambulatory physiological monitoring – that is, monitoring physiological reactions as people go about their daily lives – has a long history in biomedical research and an array of monitoring devices exist (Fahrenberg & Myrtek, 1996). Among the biological signals that can now be measured in daily life with portable signal recording devices are the electrocardiogram (ECG), blood pressure, electrodermal activity (or “sweat response”), body temperature, and even the electroencephalogram (EEG) (Wilhelm & Grossman, 2010). Most recently, researchers have added **ambulatory**

assessment of hormones (e.g., cortisol) and other biomarkers (e.g., immune markers) to the list (Schlotz, 2012). The development of ever more sophisticated ways to track what goes on underneath our skins as we go about our lives is a fascinating and rapidly advancing field.

In a recent study, Lane, Zareba, Reis, Peterson, and Moss (2011) used experience sampling combined with ambulatory electrocardiography (a so-called Holter monitor) to study how emotional experiences can alter cardiac function in patients with a congenital heart abnormality (e.g., long QT syndrome). Consistent with the idea that emotions may, in some cases, be able to trigger a cardiac event, they found that typical—in most cases even relatively low intensity—daily emotions had a measurable effect on ventricular repolarization, an important cardiac indicator that, in these patients, is linked to risk of a cardiac event. In another study, Smyth and colleagues (1998) combined experience sampling with momentary assessment of cortisol, a stress hormone. They found that momentary reports of current or even anticipated stress predicted increased cortisol secretion 20 minutes later. Further, and independent of that, the experience of other kinds of negative affect (e.g., anger, frustration) also predicted higher levels of cortisol and the experience of positive affect (e.g., happy, joyful) predicted lower levels of this important stress hormone. Taken together, these studies illustrate how researchers can use ambulatory physiological monitoring to study how the little—and seemingly trivial or inconsequential—experiences in our lives leave objective, measurable traces in our bodily systems.

Studying Online Behavior

Another domain of daily life that has only recently emerged is virtual daily behavior or how people act and interact with

others on the Internet. Irrespective of whether social media will turn out to be humanity's blessing or curse (both scientists and laypeople are currently divided over this question), the fact is that people are spending an ever increasing amount of time online. In light of that, researchers are beginning to think of virtual behavior as being as serious as “actual” behavior and seek to make it a legitimate target of their investigations (Gosling & Johnson, 2010).



Online activity reveals a lot of psychological information to researchers. [Image: Sarah C. Frey, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

One way to study virtual behavior is to make use of the fact that most of what people do on the Web—emailing, chatting, tweeting, blogging, posting—leaves direct (and permanent) verbal traces. For example, differences in the ways in which people use words (e.g., subtle preferences in word choice) have been found to carry a lot

of psychological information (Pennebaker, Mehl, & Niederhoffer, 2003). Therefore, a good way to study virtual social behavior is to study virtual language behavior. Researchers can download people's—often public—verbal expressions and communications and analyze them using modern text analysis programs (e.g., Pennebaker, Francis, & Booth, 2001).

For example, Cohn, Mehl, and Pennebaker (2004) downloaded blogs of more than a thousand users of lifejournal.com, one of the first Internet blogging sites, to study how people responded socially and emotionally to the attacks of September 11, 2001. In going “the online route,” they could bypass a critical limitation of coping research, the inability to obtain baseline information; that is, how people were doing

before the traumatic event occurred. Through access to the database of public blogs, they downloaded entries from two months prior to two months after the attacks. Their **linguistic analyses** revealed that in the first days after the attacks, participants expectedly expressed more negative emotions and were more cognitively and socially engaged, asking questions and sending messages of support. Already after two weeks, though, their moods and social engagement returned to baseline, and, interestingly, their use of cognitive-analytic words (e.g., “think,” “question”) even dropped below their normal level. Over the next six weeks, their mood hovered around their pre-9/11 baseline, but both their social engagement and cognitive-analytic processing stayed remarkably low. This suggests a social and cognitive weariness in the aftermath of the attacks. In using virtual verbal behavior as a marker of psychological functioning, this study was able to draw a fine timeline of how humans cope with disasters.

Reflecting their rapidly growing real-world importance, researchers are now beginning to investigate behavior on social networking sites such as Facebook (**Wilson, Gosling, & Graham, 2012**). Most research looks at psychological correlates of online behavior such as personality traits and the quality of one’s social life but, importantly, there are also first attempts to export traditional experimental research designs into an online setting. In a pioneering study of online social influence, Bond and colleagues (**2012**) experimentally tested the effects that peer feedback has on voting behavior. Remarkably, their sample consisted of 16 million (!) Facebook users. They found that online political-mobilization messages (e.g., “I voted” accompanied by selected pictures of their Facebook friends) influenced real-world voting behavior. This was true not just for users who saw the messages but also for their friends and friends of their friends. Although the intervention effect on a single user was very small, through the enormous number of users and indirect social contagion effects, it resulted

cumulatively in an estimated 340,000 additional votes—enough to tilt a close election. In short, although still in its infancy, research on virtual daily behavior is bound to change social science, and it has already helped us better understand both virtual and “actual” behavior.

“Smartphone Psychology”?

A review of research methods for studying daily life would not be complete without a vision of “what’s next.” Given how common they have become, it is safe to predict that smartphones will not just remain devices for everyday online communication but will also become devices for scientific data collection and intervention (**Kaplan & Stone, 2013; Yarkoni, 2012**). These devices automatically store vast amounts of real-world user interaction data, and, in addition, they are equipped with sensors to track the physical (e. g., location, position) and social (e.g., wireless connections around the phone) context of these interactions. Miller (**2012**, p. 234) states, “The question is not whether smartphones will revolutionize psychology but how, when, and where the revolution will happen.” Obviously, their immense potential for data collection also brings with it big new challenges for researchers (e.g., privacy protection, data analysis, and synthesis). Yet it is clear that many of the methods described in this module—and many still to be developed ways of collecting real-world data—will, in the future, become integrated into the devices that people naturally and happily carry with them from the moment they get up in the morning to the moment they go to bed.

Psychology and Climate Change

Climate change is an important topic, and one where psychology is making a big impact. Learn more in the following interactive resource:



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<https://ecampusontario.pressbooks.pub/testbookje/?p=392#h5p-367>

Conclusion

This module sought to make a case for psychology research conducted outside the lab. If the ultimate goal of the social and behavioral sciences is to explain human behavior, then researchers must also—in addition to conducting carefully controlled lab studies—deal with the “messy” real world and find ways to capture life as it naturally happens.

Mortensen and Cialdini (2010) refer to the dynamic give-and-take between laboratory and field research as “**full-cycle psychology**”. Going full cycle, they suggest, means that “researchers use naturalistic observation to determine an effect’s presence in the real world, theory to determine what processes underlie the effect, experimentation to verify the effect and its underlying processes, and a return to the natural environment to corroborate the experimental findings” (Mortensen & Cialdini, 2010, p. 53). To accomplish this, researchers have access to a toolbox of research methods for

studying daily life that is now more diverse and more versatile than it has ever been before. So, all it takes is to go ahead and—literally—bring science to life.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Ambulatory assessment

An overarching term to describe methodologies that assess the behavior, physiology, experience, and environments of humans in naturalistic settings.

Daily Diary method

A methodology where participants complete a questionnaire about their thoughts, feelings, and behavior of the day at the end of the day.

Day reconstruction method (DRM)

A methodology where participants describe their experiences and behavior of a given day retrospectively upon a systematic reconstruction on the following day.

Ecological momentary assessment

An overarching term to describe methodologies that repeatedly sample participants' real-world experiences, behavior, and physiology in real time.

Ecological validity

The degree to which a study finding has been obtained under conditions that are typical for what happens in everyday life.

Electronically activated recorder, or EAR

A methodology where participants wear a small, portable

audio recorder that intermittently records snippets of ambient sounds around them.

Experience-sampling method

A methodology where participants report on their momentary thoughts, feelings, and behaviors at different points in time over the course of a day.

External validity

The degree to which a finding generalizes from the specific sample and context of a study to some larger population and broader settings.

Full-cycle psychology

A scientific approach whereby researchers start with an observational field study to identify an effect in the real world, follow up with laboratory experimentation to verify the effect and isolate the causal mechanisms, and return to field research to corroborate their experimental findings.

Generalize

Generalizing, in science, refers to the ability to arrive at broad conclusions based on a smaller sample of observations. For these conclusions to be true the sample should accurately represent the larger population from which it is drawn.

Internal validity

The degree to which a cause-effect relationship between two variables has been unambiguously established.

Linguistic inquiry and word count

A quantitative text analysis methodology that automatically extracts grammatical and psychological information from a text by counting word frequencies.

Lived day analysis

A methodology where a research team follows an individual around with a video camera to objectively document a person's daily life as it is lived.

White coat hypertension

A phenomenon in which patients exhibit elevated blood

pressure in the hospital or doctor's office but not in their everyday lives.

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7. Research Designs

Original chapter by Christie Napa Scollon
adapted by the Queen's University
Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

Psychologists test research questions using a variety of methods. Most research relies on either correlations or experiments. With correlations, researchers measure variables as they naturally occur in people and compute the degree to which two variables go together. With experiments, researchers actively make changes in one variable and watch for changes in another variable. Experiments allow researchers to make causal inferences. Other types of methods include longitudinal and quasi-experimental designs. Many factors, including practical constraints, determine the type of methods researchers use. Often researchers survey people even though it would be better, but more expensive and time consuming, to track them longitudinally.

Learning Objectives

- Articulate the difference between correlational and experimental designs.

- Understand how to interpret correlations.
- Understand how experiments help us to infer causality.
- Understand how surveys relate to correlational and experimental research.
- Explain what a longitudinal study is.
- List a strength and weakness of different research designs.

Research Designs

In the early 1970's, a man named Uri Geller tricked the world: he convinced hundreds of thousands of people that he could bend spoons and slow watches using only the power of his mind. In fact, if you were in the audience, you would have likely believed he had psychic powers. Everything looked authentic—this man had to have paranormal abilities! So, why have you probably never heard of him before? Because when Uri was asked to perform his miracles in line with scientific experimentation, he was no longer able to do them. That is, even though it seemed like he was doing the impossible, when he was tested by science, he proved to be nothing more than a clever magician.

When we look at dinosaur bones to make educated guesses about extinct life, or systematically chart the heavens to learn about the relationships between stars and planets, or study magicians to figure out how they perform their tricks, we are forming observations—the foundation of science. Although we are all familiar with the saying “seeing is believing,” conducting science is more than just what your eyes perceive. Science is the result of systematic and intentional study of the natural world. And psychology is no different. In the movie *Jerry Maguire*, Cuba Gooding, Jr. became famous for using the phrase, “Show me the money!” In psychology, as in all sciences, we might say, “Show me the data!”

One of the important steps in scientific inquiry is to test our

research questions, otherwise known as hypotheses. However, there are many ways to test hypotheses in psychological research. Which method you choose will depend on the type of questions you are asking, as well as what resources are available to you. All methods have limitations, which is why the best research uses a variety of methods.

Most psychological research can be divided into two types: experimental and correlational research.

Experimental Research

If somebody gave you \$20 that absolutely had to be spent today, how would you choose to spend it? Would you spend it on an item you've been eyeing for weeks, or would you donate the money to charity? Which option do you think would bring you the most happiness? If you're like most people, you'd choose to spend the money on yourself (duh, right?). Our intuition is that we'd be happier if we spent the money on ourselves.



At the Corner Perk Cafe customers routinely pay for the drinks of strangers. Is this the way to get the most happiness out of a cup of coffee? Elizabeth Dunn's research shows that spending money on others may affect our happiness differently than spending money on ourselves. [Image: The Island Packet, <https://goo.gl/DMxA5n>]

Knowing that our intuition can sometimes be wrong, Professor Elizabeth Dunn (2008) at the University of British Columbia set out to conduct an experiment on spending and happiness. She gave each of the participants in her experiment \$20 and then told them they had to spend the money by the end of the day. Some of the participants were told they must spend the money on themselves, and some were told they must spend the

money on others (either charity or a gift for someone). At the end of the day she measured participants' levels of happiness using a self-report questionnaire. (But wait, how do you measure something like happiness when you can't really see it? Psychologists measure many abstract concepts, such as happiness and intelligence, by beginning with **operational definitions** of the concepts. See the Noba modules on Intelligence [<http://noba.to/ncb2h79v>] and Happiness [<http://noba.to/qnw7g32t>], respectively, for more information on specific measurement strategies.)

In an experiment, researchers manipulate, or cause changes, in the **independent variable**, and observe or measure any impact of those changes in the **dependent variable**. The independent variable is the one under the experimenter's control, or the variable that is intentionally altered between groups. In the case of Dunn's experiment, the independent variable was whether participants spent the money on themselves or on others. The dependent variable is the variable that is not manipulated at all, or the one where the effect

happens. One way to help remember this is that the dependent variable “depends” on what happens to the independent variable. In our example, the participants’ happiness (the dependent variable in this experiment) depends on how the participants spend their money (the independent variable). Thus, any observed changes or group differences in happiness can be attributed to whom the money was spent on. What Dunn and her colleagues found was that, after all the spending had been done, the people who had spent the money on others were happier than those who had spent the money on themselves. In other words, spending on others causes us to be happier than spending on ourselves. Do you find this surprising?

But wait! Doesn’t happiness depend on a lot of different factors—for instance, a person’s upbringing or life circumstances? What if some people had happy childhoods and that’s why they’re happier? Or what if some people dropped their toast that morning and it fell jam-side down and ruined their whole day? It is correct to recognize that these factors and many more can easily affect a person’s level of happiness. So how can we accurately conclude that spending money on others causes happiness, as in the case of Dunn’s experiment?

The most important thing about experiments is **random assignment**. Participants don’t get to pick which condition they are in (e.g., participants didn’t choose whether they were supposed to spend the money on themselves versus others). The experimenter assigns them to a particular condition based on the flip of a coin or the roll of a die or any other random method. Why do researchers do this? With Dunn’s study, there is the obvious reason: you can imagine which condition most people would choose to be in, if given the choice. But another equally important reason is that random assignment makes it so the groups, on average, are similar on all characteristics except what the experimenter manipulates.

By randomly assigning people to conditions (self-spending versus other-spending), some people with happy childhoods should end up in each condition. Likewise, some people who had dropped their toast that morning (or experienced some other disappointment) should end up in each condition. As a result, the distribution of all these factors will generally be consistent across the two groups, and this means that on average the two groups will be relatively equivalent on all these factors. Random assignment is critical to experimentation because if the only difference between the two groups is the independent variable, we can infer that the independent variable is the cause of any observable difference (e.g., in the amount of happiness they feel at the end of the day).

Here's another example of the importance of random assignment: Let's say your class is going to form two basketball teams, and you get to be the captain of one team. The class is to be divided evenly between the two teams. If you get to pick the players for your team first, whom will you pick? You'll probably pick the tallest members of the class or the most athletic. You probably won't pick the short, uncoordinated people, unless there are no other options. As a result, your team will be taller and more athletic than the other team. But what if we want the teams to be fair? How can we do this when we have people of varying height and ability? All we have to do is randomly assign players to the two teams. Most likely, some tall and some short people will end up on your team, and some tall and some short people will end up on the other team. The average height of the teams will be approximately the same. That is the power of random assignment!

Other considerations

In addition to using random assignment, you should avoid introducing confounds into your experiments. Confounds are

things that could undermine your ability to draw causal inferences. For example, if you wanted to test if a new happy pill will make people happier, you could randomly assign participants to take the happy pill or not (the independent variable) and compare these two groups on their self-reported happiness (the dependent variable). However, if some participants know they are getting the happy pill, they might develop expectations that influence their self-reported happiness. This is sometimes known as a placebo effect. Sometimes a person just knowing that he or she is receiving special treatment or something new is enough to actually cause changes in behavior or perception: In other words, even if the participants in the happy pill condition were to report being happier, we wouldn't know if the pill was actually making them happier or if it was the placebo effect—an example of a confound. A related idea is participant demand. This occurs when participants try to behave in a way they think the experimenter wants them to behave. Placebo effects and participant demand often occur unintentionally. Even experimenter expectations can influence the outcome of a study. For example, if the experimenter knows who took the happy pill and who did not, and the dependent variable is the experimenter's observations of people's happiness, then the experimenter might perceive improvements in the happy pill group that are not really there.

One way to prevent these confounds from affecting the results of a study is to use a double-blind procedure. In a double-blind procedure, neither the participant nor the experimenter knows which condition the participant is in. For example, when participants are given the happy pill or the fake pill, they don't know which one they are receiving. This way the participants shouldn't experience the placebo effect, and will be unable to behave as the researcher expects (participant demand). Likewise, the researcher doesn't know which pill each participant is taking (at least in the beginning—later, the

researcher will get the results for data-analysis purposes), which means the researcher's expectations can't influence his or her observations. Therefore, because both parties are "blind" to the condition, neither will be able to behave in a way that introduces a confound. At the end of the day, the only difference between groups will be which pills the participants received, allowing the researcher to determine if the happy pill actually caused people to be happier.

Correlational Designs

When scientists passively observe and measure phenomena it is called correlational research. Here, we do not intervene and change behavior, as we do in experiments. In correlational research, we identify patterns of relationships, but we usually cannot infer what causes what. Importantly, with correlational research, you can examine only two variables at a time, no more and no less.

So, what if you wanted to test whether spending on others is related to happiness, but you don't have \$20 to give to each participant? You could use a correlational design—which is exactly what Professor Dunn did, too. She asked people how much of their income they spent on others or donated to charity, and later she asked them how happy they were. Do you think these two variables were related? Yes, they were! The more money people reported spending on others, the happier they were.

More details about the correlation

To find out how well two variables correspond, we can plot the relation between the two scores on what is known as a

scatterplot (Figure 1). In the scatterplot, each dot represents a data point. (In this case it's individuals, but it could be some other unit.) Importantly, each dot provides us with two pieces of information—in this case, information about how good the person rated the past month (x-axis) and how happy the person felt in the past month (y-axis). Which variable is plotted on which axis does not matter.

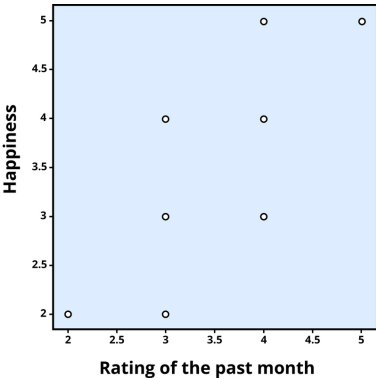


Figure 1. Scatterplot of the association between happiness and ratings of the past month, a positive correlation ($r = .81$). Each dot represents an individual.

The association between two variables can be summarized statistically using the correlation coefficient (abbreviated as r). A **correlation** coefficient provides information about the direction and strength of the association between two variables. For the example above, the direction of the association is positive. This means that people who perceived the past month as being good reported feeling

more happy, whereas people who perceived the month as being bad reported feeling less happy.

With a positive correlation, the two variables go up or down together. In a scatterplot, the dots form a pattern that extends from the bottom left to the upper right (just as they do in Figure 1). The r value for a positive correlation is indicated by a positive number (although, the positive sign is usually omitted). Here, the r value is .81.

A negative correlation is one in which the two variables move in opposite directions. That is, as one variable goes up, the other goes down. Figure 2 shows the association between the average height of males in a country (y-axis) and the pathogen prevalence (or commonness of disease; x-axis) of that country.

In this scatterplot, each dot represents a country. Notice how the dots extend from the top left to the bottom right. What does this mean in real-world terms? It means that people are shorter in parts of the world where there is more disease. The r value for a negative correlation is indicated by a negative number—that is, it has a minus (–) sign in front of it. Here, it is $-.83$.

The strength of a correlation has to do with how well the two variables align. Recall that in Professor Dunn’s correlational study, spending on others positively correlated with happiness: The more money people reported spending on others, the happier they reported to be. At this point you may be thinking to yourself, I know a very generous person who gave away lots of money to

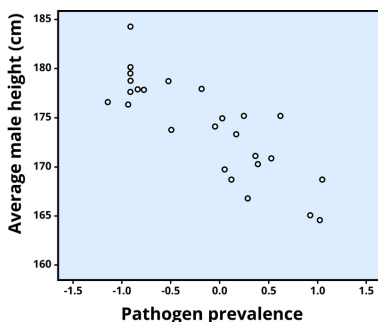


Figure 2. Scatterplot showing the association between average male height and pathogen prevalence, a negative correlation ($r = -.83$). Each dot represents a country. (Chiao, 2009)

other people but is miserable! Or maybe you know of a very stingy person who is happy as can be. Yes, there might be exceptions. If an association has many exceptions, it is considered a weak correlation. If an association has few or no exceptions, it is considered a strong correlation. A strong correlation is one in which the two variables always, or almost always, go together. In the example of happiness and how good the month has been, the association is strong. The stronger a correlation is, the tighter the dots in the scatterplot will be arranged along a sloped line.

The r value of a strong correlation will have a high absolute value. In other words, you disregard whether there is a negative sign in front of the r value, and just consider the size of the numerical value itself. If the absolute value is large, it is a strong

correlation. A weak correlation is one in which the two variables correspond some of the time, but not most of the time. Figure 3 shows the relation between valuing happiness and grade point average (GPA). People who valued happiness more tended to earn slightly lower grades, but there were lots of exceptions to this. The r value for a weak correlation will have a low absolute value. If two variables are so weakly related as to be unrelated, we say they are uncorrelated, and the r value will be zero or very close to zero. In the previous example, is the correlation between height and pathogen prevalence strong? Compared to Figure 3, the dots in Figure 2 are tighter and less dispersed. The absolute value of -0.83 is large. Therefore, it is a strong negative correlation.



Figure 3. Scatterplot showing the association between valuing happiness and GPA, a weak negative correlation ($r = -.32$). Each dot represents an individual.

Can you guess the strength and direction of the correlation between age and year of birth? If you said this is a strong negative correlation, you are correct! Older people always have lower years of birth than younger people (e.g., 1950 vs. 1995), but at the same time, the older people will have a higher age (e.g., 65 vs. 20). In fact, this is a perfect correlation because there are no exceptions to this pattern.

I challenge you to find a 10-year-old born before 2003! You can't.

Problems with the correlation

If generosity and happiness are positively correlated, should we conclude that being generous causes happiness? Similarly,

if height and pathogen prevalence are negatively correlated, should we conclude that disease causes shortness? From a correlation alone, we can't be certain. For example, in the first case it may be that happiness causes generosity, or that generosity causes happiness. Or, a third variable might cause both happiness *and* generosity, creating the illusion of a direct link between the two. For example, wealth could be the third variable that causes both greater happiness and greater generosity. This is why correlation does not mean causation—an often repeated phrase among psychologists.

Qualitative Designs

Just as correlational research allows us to study topics we can't experimentally manipulate (e.g., whether you have a large or small income), there are other types of research designs that allow us to investigate these harder-to-study topics. Qualitative designs, including participant observation, case studies, and narrative analysis are examples of such methodologies. Although something as simple as "observation" may seem like it would be a part of all research methods, participant observation is a distinct methodology that involves the researcher embedding him- or herself into a group in order to study its dynamics. For example, Festinger, Riecken, and Shacter (1956) were very interested in the psychology of a particular cult. However, this cult was very secretive and wouldn't grant interviews to outside members. So, in order to study these people, Festinger and his colleagues pretended to be cult members, allowing them access to the behavior and psychology of the cult. Despite this example, it should be noted that the people being observed in a participant observation study usually know that the researcher is there to study them.

Another qualitative method for research is the case study, which involves an intensive examination of specific individuals

or specific contexts. Sigmund Freud, the father of psychoanalysis, was famous for using this type of methodology; however, more current examples of case studies usually involve brain injuries. For instance, imagine that researchers want to know how a very specific brain injury affects people's experience of happiness. Obviously, the researchers can't conduct experimental research that involves inflicting this type of injury on people. At the same time, there are too few people who have this type of injury to conduct correlational research. In such an instance, the researcher may examine only one person with this brain injury, but in doing so, the researcher will put the participant through a very extensive round of tests. Hopefully what is learned from this one person can be applied to others; however, even with thorough tests, there is the chance that something unique about this individual (other than the brain injury) will affect his or her happiness. But with such a limited number of possible participants, a case study is really the only type of methodology suitable for researching this brain injury.

The final qualitative method to be discussed in this section is narrative analysis. Narrative analysis centers around the study of stories and personal accounts of people, groups, or cultures. In this methodology, rather than engaging with participants directly, or quantifying their responses or behaviors, researchers will analyze the themes, structure, and dialogue of each person's narrative. That is, a researcher will examine people's personal testimonies in order to learn more about the psychology of those individuals or groups. These stories may be written, audio-recorded, or video-recorded, and allow the researcher not only to study *what* the participant says but *how* he or she says it. Every person has a unique perspective on the world, and studying the way he or she conveys a story can provide insight into that perspective.

Quasi-Experimental Designs

What if you want to study the effects of marriage on a variable? For example, does marriage make people happier? Can you randomly assign some people to get married and others to remain single? Of course not. So how can you study these important variables? You can use a **quasi-experimental design**.

A quasi-experimental design is similar to experimental research, except that random assignment to conditions is not used. Instead, we rely on existing group memberships (e.g., married vs. single). We treat these as the independent variables, even though we don't assign people to the conditions and don't manipulate the variables. As a result, with quasi-experimental designs causal inference is more



What is a reasonable way to study the effects of marriage on happiness? [Image: Nina Matthews Photography, <https://goo.gl/lcmLqg>, CC BY-NC-SA, <https://goo.gl/HSisdg>]

difficult. For example, married people might differ on a variety of characteristics from unmarried people. If we find that married participants are happier than single participants, it will be hard to say that marriage causes happiness, because the people who got married might have already been happier than the people who have remained single.

Because experimental and quasi-experimental designs can seem pretty similar, let's take another example to distinguish them. Imagine you want to know who is a better professor: Dr. Smith or Dr. Khan. To judge their ability, you're going to look at their students' final grades. Here, the independent variable

is the professor (Dr. Smith vs. Dr. Khan) and the dependent variable is the students' grades. In an experimental design, you would randomly assign students to one of the two professors and then compare the students' final grades. However, in real life, researchers can't randomly force students to take one professor over the other; instead, the researchers would just have to use the preexisting classes and study them as-is (quasi-experimental design). Again, the key difference is random assignment to the conditions of the independent variable. Although the quasi-experimental design (where the students choose which professor they want) may seem random, it's most likely not. For example, maybe students heard Dr. Smith sets low expectations, so slackers prefer this class, whereas Dr. Khan sets higher expectations, so smarter students prefer that one. This now introduces a confounding variable (student intelligence) that will almost certainly have an effect on students' final grades, regardless of how skilled the professor is. So, even though a quasi-experimental design is similar to an experimental design (i.e., it has a manipulated independent variable), because there's no random assignment, you can't reasonably draw the same conclusions that you would with an experimental design.

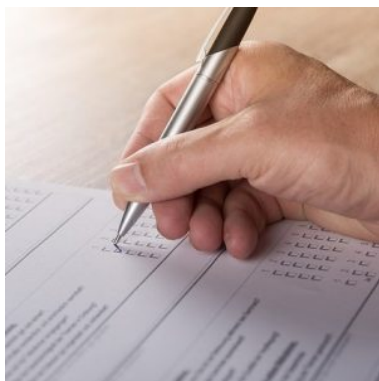
Longitudinal Studies

Another powerful research design is the **longitudinal study**. Longitudinal studies track the same people over time. Some longitudinal studies last a few weeks, some a few months, some a year or more. Some studies that have contributed a lot to psychology followed the same people over decades. For example, one study followed more than 20,000 Germans for two decades. From these longitudinal data, psychologist Rich Lucas (2003) was able to determine that people who end up getting married indeed start off a bit happier than their peers

who never marry. Longitudinal studies like this provide valuable evidence for testing many theories in psychology, but they can be quite costly to conduct, especially if they follow many people for many years.

Surveys

A survey is a way of gathering information, using old-fashioned questionnaires or the Internet. Compared to a study conducted in a psychology laboratory, surveys can reach a larger number of participants at a much lower cost. Although surveys are typically used for correlational research, this is not always the case. An experiment can be carried out using surveys as well. For example, King and Napa (1998) presented participants with different types of stimuli



Surveys provide researchers with some significant advantages in gathering data. They make it possible to reach large numbers of people while keeping costs to the researchers and the time commitments of participants relatively low.

on paper: either a survey completed by a happy person or a survey completed by an unhappy person. They wanted to see whether happy people were judged as more likely to get into heaven compared to unhappy people. Can you figure out the independent and dependent variables in this study? Can you guess what the results were? Happy people (vs. unhappy people; the independent variable) were judged as more likely to go to heaven (the dependent variable) compared to unhappy people!

Likewise, correlational research can be conducted without

the use of surveys. For instance, psychologists LeeAnn Harker and Dacher Keltner (2001) examined the smile intensity of women's college yearbook photos. Smiling in the photos was correlated with being married 10 years later!

Tradeoffs in Research

Even though there are serious limitations to correlational and quasi-experimental research, they are not poor cousins to experiments and longitudinal designs. In addition to selecting a method that is appropriate to the question, many practical concerns may influence the decision to use one method over another. One of these factors is simply resource availability—how much time and money do you have to invest in the research? (Tip: If you're doing a senior honor's thesis, do not embark on a lengthy longitudinal study unless you are prepared to delay graduation!) Often, we survey people even though it would be more precise—but much more difficult—to track them longitudinally. Especially in the case of exploratory research, it may make sense to opt for a cheaper and faster method first. Then, if results from the initial study are promising, the researcher can follow up with a more intensive method.

Beyond these practical concerns, another consideration in selecting a research design is the ethics of the study. For example, in cases of brain injury or other neurological abnormalities, it would be unethical for researchers to inflict these impairments on healthy participants. Nonetheless, studying people with these injuries can provide great insight into human psychology (e.g., if we learn that damage to a particular region of the brain interferes with emotions, we may be able to develop treatments for emotional irregularities). In addition to brain injuries, there are numerous other areas of research that could be useful in understanding the human

mind but which pose challenges to a true experimental design—such as the experiences of war, long-term isolation, abusive parenting, or prolonged drug use. However, none of these are conditions we could ethically experimentally manipulate and randomly assign people to. Therefore, ethical considerations are another crucial factor in determining an appropriate research design.

Research Methods: Why You Need Them

Just look at any major news outlet and you'll find research routinely being reported. Sometimes the journalist understands the research methodology, sometimes not (e.g., correlational evidence is often incorrectly represented as causal evidence). Often, the media are quick to draw a conclusion for you. After reading this module, you should recognize that the strength of a scientific finding lies in the strength of its methodology. Therefore, in order to be a savvy consumer of research, you need to understand the pros and cons of different methods and the distinctions among them. Plus, understanding how psychologists systematically go about answering research questions will help you to solve problems in other domains, both personal and professional, not just in psychology.

Research Matters

This video is an advertisement, so the scientific details are not at the threshold we would expect for this class. That said, this video shows the importance of curiosity and the drive to solve problems in research. If you are motivated to understand and solve problems, research is a tool you can use!



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Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Confounds

Factors that undermine the ability to draw causal inferences from an experiment.

Correlation

Measures the association between two variables, or how they go together.

Dependent variable

The variable the researcher measures but does not manipulate in an experiment.

Experimenter expectations

When the experimenter's expectations influence the outcome of a study.

Independent variable

The variable the researcher manipulates and controls in an experiment.

Longitudinal study

A study that follows the same group of individuals over time.

Operational definitions

How researchers specifically measure a concept.

Participant demand

When participants behave in a way that they think the experimenter wants them to behave.

Placebo effect

When receiving special treatment or something new affects human behavior.

Quasi-experimental design

An experiment that does not require random assignment to conditions.

Random assignment

Assigning participants to receive different conditions of an experiment by chance.

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PSYC 100 III

GENETICS AND EVOLUTION

8. Epigenetics in Psychology

Original chapter by Ian Weaver adapted by
Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen’s Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

Early life experiences exert a profound and long-lasting influence on physical and mental health throughout life. The efforts to identify the primary causes of this have significantly benefited from studies of the epigenome—a dynamic layer of information associated with DNA that differs between individuals and can be altered through various experiences and environments. The epigenome has been heralded as a key “missing piece” of the etiological puzzle for understanding how development of psychological disorders may be influenced by the surrounding environment, in concordance with the genome. Understanding the mechanisms involved in the initiation, maintenance, and heritability of epigenetic states is thus an important aspect of research in current biology, particularly in the study of learning and memory, emotion, and social behavior in humans. Moreover, epigenetics in psychology provides a framework for understanding how the expression of genes is influenced by experiences and the environment to produce individual differences in behavior,

cognition, personality, and mental health. In this module, we survey recent developments revealing epigenetic aspects of mental health and review some of the challenges of epigenetic approaches in psychology to help explain how nurture shapes nature.

Learning Objectives

- Explain what the term epigenetics means and the molecular machinery involved.
- Name and discuss important neural and developmental pathways that are regulated by epigenetic factors, and provide examples of epigenetic effects on personality traits and cognitive behavior.
- Understand how misregulation of epigenetic mechanisms can lead to disease states, and be able to discuss examples.
- Recognize how epigenetic machinery can be targets for therapeutic agents, and discuss examples.

Introduction



DNA stands for Deoxyribonucleic Acid, and although each person's DNA is unique to that individual, it is 99.9% similar to every other human on the planet. [Image: CCO Public Domain, <https://goo.gl/m25gce>]

Early childhood is not only a period of physical growth; it is also a time of mental development related to changes in the anatomy, physiology, and chemistry of the nervous system that influence mental health throughout life. Cognitive abilities associated with learning and memory, reasoning, problem solving, and developing relationships continue to emerge during childhood.

Brain development is more rapid during this critical or

sensitive period than at any other, with more than 700 neural connections created each second. Herein, complex **gene**–environment interactions (or genotype–environment interactions, $G \times E$) serve to increase the number of possible contacts between neurons, as they hone their adult synaptic properties and excitability. Many weak connections form to different neuronal targets; subsequently, they undergo remodeling in which most connections vanish and a few stable connections remain. These structural changes (or plasticity) may be crucial for the development of mature neural networks that support emotional, cognitive, and social behavior. The generation of different morphology, physiology, and behavioral outcomes from a single genome in response to changes in the environment forms the basis for “phenotypic plasticity,” which is fundamental to the way organisms cope with environmental

variation, navigate the present world, and solve future problems.

The challenge for psychology has been to integrate findings from genetics and environmental (social, biological, chemical) factors, including the quality of infant–mother attachments, into the study of personality and our understanding of the emergence of mental illness. These studies have demonstrated that common DNA sequence variation and rare mutations account for only a small fraction (1%–2%) of the total risk for inheritance of personality traits and mental disorders (**Dick, Riley, & Kendler, 2010; Gershon, Alliey-Rodriguez, & Liu, 2011**). Additionally, studies that have attempted to examine the mechanisms and conditions under which DNA sequence variation influences brain development and function have been confounded by complex cause-and-effect relationships (**Petronis, 2010**). The large unaccounted heritability of personality traits and mental health suggests that additional molecular and cellular mechanisms are involved.

Epigenetics has the potential to provide answers to these important questions and refers to the transmission of **phenotype** in terms of gene expression in the absence of changes in DNA sequence—hence the name epi- (Greek: ἐπί-over, above) genetics (**Waddington, 1942; Wolffe & Matzke, 1999**). The advent of high-throughput techniques such as sequencing-based approaches to study the distributions of regulators of gene expression throughout the genome led to the collective description of the “epigenome.” In contrast to the genome sequence, which is static and the same in almost all cells, the **epigenome** is highly dynamic, differing among cell types, tissues, and brain regions (**Gregg et al., 2010**). Recent studies have provided insights into epigenetic regulation of developmental pathways in response to a range of external environmental factors (**Dolinoy, Weidman, & Jirtle, 2007**). These environmental factors during early childhood and

adolescence can cause changes in expression of genes conferring risk of mental health and chronic physical conditions. Thus, the examination of genetic–epigenetic–environment interactions from a developmental perspective may determine the nature of gene misregulation in psychological disorders.

This module will provide an overview of the main components of the epigenome and review themes in recent epigenetic research that have relevance for psychology, to form the biological basis for the interplay between environmental signals and the genome in the regulation of individual differences in physiology, emotion, cognition, and behavior.

A “Big Picture” Insight into Epi-Genetics

Epigenetics is a content area where students sometimes feel apprehensive, especially if they do not have a background in biology. This course will teach you all required biology content expected for this class. To help get you excited about the importance of this research field, please watch the following video. It provides insights into why it is so important for behavioural scientists to understand, at least on a surface level, about the field of epigenetics. This video is not intended as a replacement for the content in this module, but rather is intended to serve as a big-picture framework for you to better understand the content in this module.



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Molecular control of gene expression: the dynamic epigenome

Almost all the cells in our body are genetically identical, yet our body generates many different cell types, organized into different tissues and organs, and expresses different proteins. Within each type of mammalian cell, about 2 meters of genomic DNA is divided into nuclear chromosomes. Yet the nucleus of a human cell, which contains the chromosomes, is only about 2 μm in diameter. To achieve this 1,000,000-fold compaction, DNA is wrapped around a group of 8 proteins



Identical twins are the perfect example of epigenetics. Although they share exactly the same DNA, their unique experiences in life will cause some genes (and not others) to express themselves. This is why, over time, identical twins come to look and behave differently. [Image: M., <https://goo.gl/VU5iJv>, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

called histones. This combination of DNA and histone proteins forms a special structure called a “nucleosome,” the basic unit of chromatin, which represents a structural solution for maintaining and accessing the tightly compacted genome. These factors alter the likelihood that a gene will be expressed

or silenced. Cellular functions such as gene expression, DNA replication, and the generation of specific cell types are therefore influenced by distinct patterns of chromatin structure, involving covalent modification of both histones (**Kadonaga, 1998**) and DNA (**Razin, 1998**).

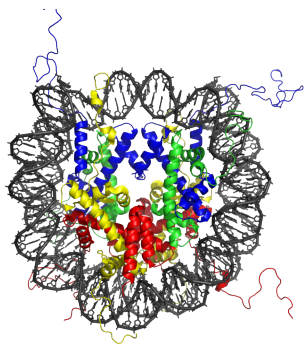
Importantly, epigenetic variation also emerges across the lifespan. For example, although **identical twins** share a common **genotype** and are genetically identical and epigenetically similar when they are young, as they age they become more dissimilar in their epigenetic patterns and often display behavioral, personality, or even physical differences, and have different risk levels for serious illness. Thus, understanding the structure of the nucleosome is key to understanding the precise and stable control of gene expression and regulation, providing a molecular interface between genes and environmentally induced changes in cellular activity.

The primary epigenetic mark: DNA modification

DNA methylation is the best-understood epigenetic modification influencing gene expression. DNA is composed of four types of naturally occurring nitrogenous bases: adenine (A), thymine (T), guanine (G), and cytosine (C). In mammalian genomes, **DNA methylation** occurs primarily at cytosine residues in the context of cytosines that are followed by guanines (CpG dinucleotides), to form 5-methylcytosine in a cell-specific pattern (**Goll & Bestor, 2005; Law & Jacobsen, 2010; Suzuki & Bird, 2008**). The enzymes that perform DNA methylation are called **DNA methyltransferases (DNMTs)**, which catalyze the transfer of a methyl group to the cytosine (**Adams, McKay, Craig, & Burdon, 1979**). These enzymes are all

expressed in the central nervous system and are dynamically regulated during development (**Feng, Chang, Li, & Fan, 2005; Goto et al., 1994**). The effect of DNA methylation on gene function varies depending on the period of development during which the methylation occurs and location of the methylated cytosine. Methylation of DNA in gene regulatory regions (promoter and enhancer regions) usually results in gene silencing and reduced gene expression (**Ooi, O'Donnell, & Bestor, 2009; Suzuki & Bird, 2008; Sutter and Doerfler, 1980; Vardimon et al., 1982**). This is a powerful regulatory mechanism that ensures that genes are expressed only when needed. Thus DNA methylation may broadly impact human brain development, and age-related misregulation of DNA methylation is associated with the molecular pathogenesis of neurodevelopmental disorders.

Histone modification and the histone code



Life experiences, like a stressful event in childhood, can cause the modification of histone proteins (pictured) to help adapt to one's environment. For example, in response to a stressful event, histone modification of one's DNA might occur to encourage a more cautious personality—in order to avoid future, stressful encounters. [Image: Zephyris, <https://goo.gl/gGrSQd>, CC BY-SA 3.0, <https://goo.gl/kBIOgc>]

The modification of histone proteins comprises an important epigenetic mark related to gene expression. One of the most thoroughly studied modifications is histone acetylation, which is associated with gene activation and increased gene expression (Wade, Pruss, & Wolffe, 1997). Acetylation on histone tails is mediated by the opposing enzymatic activities of **histone acetyltransferases (HATs)** and **histone deacetylases (HDACs)** (Kuo & Allis, 1998). For example, acetylation of histone in gene regulatory regions by HAT enzymes is generally

associated with DNA demethylation, gene activation, and increased gene expression (Hong, Schroth, Matthews, Yau, & Bradbury, 1993; Sealy & Chalkley, 1978). On the other hand, removal of the acetyl group (deacetylation) by HDAC enzymes is generally associated with DNA methylation, gene silencing, and decreased gene expression (Davie & Chadee, 1998). The relationship between patterns of **histone modifications** and gene activity provides evidence for the existence of a “histone code” for determining cell-specific gene expression programs (Jenuwein & Allis, 2001). Interestingly, recent research using

animal models has demonstrated that histone modifications and DNA methylation of certain genes mediates the long-term behavioral effects of the level of care experienced during infancy.

Early childhood experience

The development of an individual is an active process of adaptation that occurs within a social and economic context. For example, the closeness or degree of positive attachment of the parent (typically mother)–infant bond and parental investment (including nutrient supply provided by the parent) that define early childhood experience also program the development of individual differences in stress responses in the brain, which then affect memory, attention, and emotion. In terms of evolution, this process provides the offspring with the ability to physiologically adjust gene expression profiles contributing to the organization and function of neural circuits and molecular pathways that support (1) biological defensive systems for survival (e.g., stress resilience), (2) reproductive success to promote establishment and persistence in the present environment, and (3) adequate parenting in the next generation (**Bradshaw, 1965**).

Parental investment and programming of stress responses in the offspring

The most comprehensive study to date of variations in parental investment and epigenetic inheritance in mammals is that of the maternally transmitted responses to stress in rats. In rat pups, maternal nurturing (licking and grooming) during the first week of life is associated with long-term programming

of individual differences in stress responsiveness, emotionality, cognitive performance, and reproductive behavior (**Caldji et al., 1998; Francis, Diorio, Liu, & Meaney, 1999; Liu et al., 1997; Myers, Brunelli, Shair, Squire, & Hofer, 1989; Stern, 1997**). In adulthood, the offspring of mothers that exhibit increased levels of pup licking and grooming over the first week of life show increased expression of the glucocorticoid receptor in the hippocampus (a brain structure associated with stress responsivity as well as learning and memory) and a lower hormonal response to stress compared with adult animals reared by low licking and grooming mothers (**Francis et al., 1999; Liu et al., 1997**). Moreover, rat pups that received low levels of maternal licking and grooming during the first week of life showed decreased histone acetylation and increased DNA methylation of a neuron-specific promoter of the glucocorticoid receptor gene (**Weaver et al., 2004**). The expression of this gene is then reduced, the number of glucocorticoid receptors in the brain is decreased, and the animals show a higher hormonal response to stress throughout their life. The effects of maternal care on stress hormone responses and behaviour in the offspring can be eliminated in adulthood by pharmacological treatment (HDAC inhibitor trichostatin A, TSA) or dietary amino acid supplementation (methyl donor L-methionine), treatments that influence histone acetylation, DNA methylation, and expression of the glucocorticoid receptor gene (**Weaver et al., 2004; Weaver et al., 2005**). This series of experiments shows that histone acetylation and DNA methylation of the glucocorticoid receptor gene promoter is a necessary link in the process leading to the long-term physiological and behavioral sequelae of poor maternal care. This points to a possible molecular target for treatments that may reverse or ameliorate the traces of childhood maltreatment.

Several studies have attempted to determine to what extent the findings from model animals are transferable to humans. Examination of post-mortem brain tissue from healthy human subjects found that the human equivalent of the glucocorticoid receptor gene promoter (NR3C1 exon 1F promoter) is also unique to the individual (Turner, Pelascini, Macedo, & Muller, 2008). A similar study examining newborns showed that methylation of the glucocorticoid receptor



Parental care during one's childhood has important and consequential effects on the development of an individual, effects that persist even into adulthood. [Image: The White Ribbon Alliance, <https://goo.gl/KgY6N5>, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

gene promoter maybe an early epigenetic marker of maternal mood and risk of increased hormonal responses to stress in infants 3 months of age (Oberlander et al., 2008). Although further studies are required to examine the functional consequence of this DNA methylation, these findings are consistent with our studies in the neonate and adult offspring of low licking and grooming mothers that show increased DNA methylation of the promoter of the glucocorticoid receptor gene, decreased glucocorticoid receptor gene expression, and increased hormonal responses to stress (Weaver et al., 2004). Examination of brain tissue from suicide victims found that the human glucocorticoid receptor gene promoter is also more methylated in the brains of individuals who had experienced maltreatment during childhood (McGowan et al., 2009). These finding suggests that DNA methylation mediates the effects of early environment in both rodents and humans and points to the possibility of new therapeutic approaches stemming from

translational epigenetic research. Indeed, similar processes at comparable epigenetic labile regions could explain why the adult offspring of high and low licking/grooming mothers exhibit widespread differences in hippocampal gene expression and cognitive function (**Weaver, Meaney, & Szyf, 2006**).

However, this type of research is limited by the inaccessibility of human brain samples. The translational potential of this finding would be greatly enhanced if the relevant epigenetic modification can be measured in an accessible tissue. Examination of blood samples from adult patients with bipolar disorder, who also retrospectively reported on their experiences of childhood abuse and neglect, found that the degree of DNA methylation of the human glucocorticoid receptor gene promoter was strongly positively related to the reported experience of childhood maltreatment decades earlier. For a relationship between a molecular measure and reported historical exposure, the effects size is extraordinarily large. This opens a range of new possibilities: given the large effect size and consistency of this association, measurement of the GR promoter methylation may effectively become a blood test measuring the physiological traces left on the genome by early experiences. Although this blood test cannot replace current methods of diagnosis, this unique and additional information adds to our knowledge of how disease may arise and be manifested throughout life. Near-future research will examine whether this measure adds value over and above simple reporting of early adversities when it comes to predicting important outcomes, such as response to treatment or suicide.

Child nutrition and the epigenome



Whether or not your parents knew the science behind it, telling you to eat your veggies as a kid really does make you healthier and stronger—at least your DNA, that is. [Image: U.S. Department of Agriculture, <https://goo.gl/tpyYzA>, CC BY 2.0, <https://goo.gl/BRvSA7>]

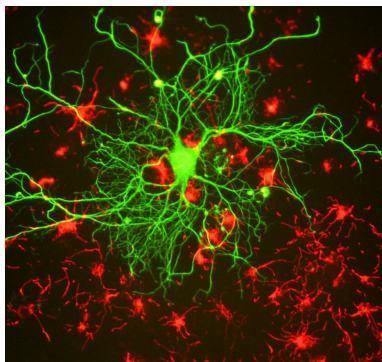
The old adage “you are what you eat” might be true on more than just a physical level: The food you choose (and even what your parents and grandparents chose) is reflected in your own personal development and risk for disease in adult life (**Wells, 2003**). Nutrients can reverse or change DNA methylation and histone modifications, thereby modifying the expression of critical genes associated with physiologic and pathologic processes, including

embryonic development, aging, and carcinogenesis. It appears that nutrients can influence the epigenome either by directly inhibiting enzymes that catalyze DNA methylation or histone modifications, or by altering the availability of substrates necessary for those enzymatic reactions. For example, rat mothers fed a diet low in methyl group donors during pregnancy produce offspring with reduced DNMT-1 expression, decreased DNA methylation, and increased histone acetylation at promoter regions of specific genes, including the glucocorticoid receptor, and increased gene expression in the liver of juvenile offspring (**Lillycrop, Phillips, Jackson, Hanson, & Burdge, 2005**) and adult offspring (**Lillycrop et al., 2007**). These data suggest that early life nutrition has the potential to influence epigenetic programming in the brain not only during early development but also in adult life, thereby modulating health throughout life. In this regard, nutritional epigenetics

has been viewed as an attractive tool to prevent pediatric developmental diseases and cancer, as well as to delay aging-associated processes.

The best evidence relating to the impact of adverse environmental conditions development and health comes from studies of the children of women who were pregnant during two civilian famines of World War II: the Siege of Leningrad (1941–44) (**Bateson, 2001**) and the Dutch Hunger Winter (1944–1945) (**Stanner et al., 1997**). In the Netherlands famine, women who were previously well nourished were subjected to low caloric intake and associated environmental stressors. Women who endured the famine in the late stages of pregnancy gave birth to smaller babies (**Lumey & Stein, 1997**) and these children had an increased risk of insulin resistance later in life (**Painter, Roseboom, & Bleker, 2005**). In addition, offspring who were starved prenatally later experienced impaired glucose tolerance in adulthood, even when food was more abundant (**Stanner et al., 1997**). Famine exposure at various stages of gestation was associated with a wide range of risks such as increased obesity, higher rates of coronary heart disease, and lower birth weight (**Lumey & Stein, 1997**). Interestingly, when examined 60 years later, people exposed to famine prenatally showed reduced DNA methylation compared with their unexposed same-sex siblings (**Heijmans et al., 2008**).

Epigenetic regulation of learning and memory



Neural plasticity is the change of neural pathways and synapses which allows for our ability to learn new things and remember them.

[Image: Gerry Shaw, <https://goo.gl/JBqIY7>, CC BY-SA 3.0, <https://goo.gl/eLCn2O>]

Memories are recollections of actual events stored within our brains. But how is our brain able to form and store these memories? Epigenetic mechanisms influence genomic activities in the brain to produce long-term changes in synaptic signaling, organization, and morphology, which in turn support learning and memory (Day & Sweatt, 2011).

Neuronal activity in the hippocampus of mice is associated with changes in

DNA methylation (Guo et al., 2011), and disruption to genes encoding the DNA methylation machinery cause learning and memory impairments (Feng et al., 2010). DNA methylation has also been implicated in the maintenance of long-term memories, as pharmacological inhibition of DNA methylation and impaired memory (Day & Sweatt, 2011; Miller et al., 2010). These findings indicate the importance of DNA methylation in mediating synaptic plasticity and cognitive functions, both of which are disturbed in psychological illness.

Changes in histone modifications can also influence long-term memory formation by altering chromatin accessibility and the expression of genes relevant to learning and memory. Memory formation and the associated enhancements in synaptic transmission are accompanied by increases in histone acetylation (Guan et al., 2002) and alterations in histone

methylation (**Schaefer et al., 2009**), which promote gene expression. Conversely, a neuronal increase in histone deacetylase activity, which promotes gene silencing, results in reduced synaptic plasticity and impairs memory (**Guan et al., 2009**). Pharmacological inhibition of histone deacetylases augments memory formation (**Guan et al., 2009; Levenson et al., 2004**), further suggesting that histone (de)acetylation regulates this process.

In humans genetic defects in genes encoding the DNA methylation and chromatin machinery exhibit profound effects on cognitive function and mental health (**Jiang, Bressler, & Beaudet, 2004**). The two best-characterized examples are Rett syndrome (**Amir et al., 1999**) and Rubinstein-Taybi syndrome (RTS) (**Alarcon et al., 2004**), which are profound intellectual disability disorders. Both MECP2 and CBP are highly expressed in neurons and are involved in regulating neural gene expression (**Chen et al., 2003; Martinowich et al., 2003**).

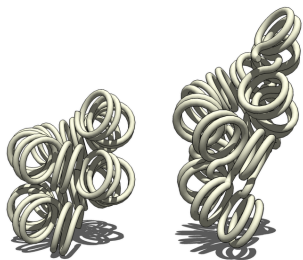
Rett syndrome patients have a mutation in their DNA sequence in a gene called MECP2. MECP2 plays many important roles within the cell: One of these roles is to read the DNA sequence, checking for DNA methylation, and to bind to areas that contain methylation, thereby preventing the wrong proteins from being present. Other roles for MECP2 include promoting the presence of particular, necessary, proteins, ensuring that DNA is packaged properly within the cell and assisting with the production of proteins. MECP2 function also influences gene expression that supports dendritic and synaptic development and hippocampus-dependent memory (**Li, Zhong, Chau, Williams, & Chang, 2011; Skene et al., 2010**). Mice with altered MECP2 expression exhibit genome-wide increases in histone acetylation, neuron cell death, increased anxiety, cognitive deficits, and social withdrawal (**Shahbazian et al., 2002**). These findings support a model in which DNA methylation and MECP2 constitute a cell-specific epigenetic

mechanism for regulation of histone modification and gene expression, which may be disrupted in Rett syndrome.

RTS patients have a mutation in their DNA sequence in a gene called CBP. One of these roles of CBP is to bind to specific histones and promote histone acetylation, thereby promoting gene expression. Consistent with this function, RTS patients exhibit a genome-wide decrease in histone acetylation and cognitive dysfunction in adulthood (**Kalkhoven et al., 2003**). The learning and memory deficits are attributed to disrupted neural plasticity (**Korzus, Rosenfeld, & Mayford, 2004**). Similar to RTS in humans, mice with a mutation of CBP perform poorly in cognitive tasks and show decreased genome-wide histone acetylation (for review, see **Josselyn, 2005**). In the mouse brain CBP was found to act as an epigenetic switch to promote the birth of new neurons in the brain. Interestingly, this epigenetic mechanism is disrupted in the fetal brains of mice with a mutation of CBP, which, as pups, exhibit early behavioral deficits following removal and separation from their mother (**Wang et al., 2010**). These findings provide a novel mechanism whereby environmental cues, acting through histone modifying enzymes, can regulate epigenetic status and thereby directly promote neurogenesis, which regulates neurobehavioral development.

Together, these studies demonstrate that misregulation of epigenetic modifications and their regulatory enzymes is capable of orchestrating prominent deficits in neuronal plasticity and cognitive function. Knowledge from these studies may provide greater insight into other mental disorders such as depression and suicidal behaviors.

Epigenetic mechanisms in psychological disorders



Pictured above is a chromatin, the spiral-looking macromolecule involved in depression. [Image: Zephyris, <https://goo.gl/6DBQ1g>, CC BY-SA 3.0, <https://goo.gl/eLCn2O>]

Epigenome-wide studies have identified several dozen sites with DNA methylation alterations in genes involved in brain development and neurotransmitter pathways, which had previously been associated with mental illness (Mill et al., 2008). These disorders are complex and typically start at a young age and cause lifelong disability. Often, limited

benefits from treatment make these diseases some of the most burdensome disorders for individuals, families, and society. It has become evident that the efforts to identify the primary causes of complex psychiatric disorders may significantly benefit from studies linking environmental effects with changes observed within the individual cells.

Epigenetic events that alter chromatin structure to regulate programs of gene expression have been associated with depression-related behavior and action of antidepressant medications, with increasing evidence for similar mechanisms occurring in post-mortem brains of depressed individuals. In mice, social avoidance resulted in decreased expression of hippocampal genes important in mediating depressive responses (Tsankova et al., 2006). Similarly, chronic social defeat stress was found to decrease expression of genes implicated in normal emotion processing (Lutter et al., 2008). Consistent with these findings, levels of histone markers of increased gene expression were down regulated in human

post-mortem brain samples from individuals with a history of clinical depression (**Covington et al., 2009**).

Administration of antidepressants increased histone markers of increased gene expression and reversed the gene repression induced by defeat stress (**Lee, Wynder, Schmidt, McCafferty, & Shiekhatter, 2006; Tsankova et al., 2006; Wilkinson et al., 2009**). These results provide support for the use of HDAC inhibitors against depression. Accordingly, several HDAC inhibitors have been found to exert antidepressant effects by each modifying distinct cellular targets (**Cassel et al., 2006; Schroeder, Lin, Crusio, & Akbarian, 2007**).

There is also increasing evidence that aberrant gene expression resulting from altered epigenetic regulation is associated with the pathophysiology of suicide (**McGowan et al., 2008; Poulter et al., 2008**). Thus, it is tempting to speculate that there is an epigenetically determined reduced capacity for gene expression, which is required for learning and memory, in the brains of suicide victims.

Epigenetic strategy to understanding gene-environment interactions

While the cellular and molecular mechanisms that influence on physical and mental health have long been a central focus of neuroscience, only in recent years has attention turned to the epigenetic mechanisms behind the dynamic changes in gene expression responsible for normal cognitive function and increased risk for mental illness. The links between early environment and epigenetic modifications suggest a mechanism underlying gene-environment interactions.



Although there is some evidence that a dysfunctional upbringing can increase one's likelihood for schizophrenia (an epigenetically inherited disease), some people who have both the predisposition and the stressful environment never develop the mental illness. [Image: Steve White, CC0 Public Domain, <https://goo.gl/m25gce>]

Early environmental adversity alone is not a sufficient cause of mental illness, because many individuals with a history of severe childhood maltreatment or trauma remain healthy. It is increasingly becoming evident that inherited differences in the segments of specific genes may moderate the effects of adversity and determine who is sensitive and who is resilient through a gene-environment interplay. Genes such as the glucocorticoid receptor appear to moderate the effects of childhood adversity on mental illness. Remarkably, epigenetic DNA modifications have been identified that may underlie the long-lasting effects of environment on biological functions.

This new epigenetic research is pointing to a new strategy to understanding gene-environment interactions.

The next decade of research will show if this potential can be exploited in the development of new therapeutic options that may alter the traces that early environment leaves on the genome. However, as discussed in this module, the epigenome is not static and can be molded by developmental signals, environmental perturbations, and disease states, which present an experimental challenge in the search for epigenetic risk factors in psychological disorders (**Rakyan, Down, Balding, & Beck, 2011**). The sample size and epigenomic assay required is dependent on the number of tissues affected, as well as the type and distribution of epigenetic modifications. The combination of genetic association maps studies with epigenome-wide developmental studies may help identify novel molecular mechanisms to explain features of inheritance of personality traits and transform our understanding of the biological basis of psychology. Importantly, these epigenetic studies may lead to identification of novel therapeutic targets and enable the development of improved strategies for early diagnosis, prevention, and better treatment of psychological and behavioral disorders.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

DNA methylation

Covalent modifications of mammalian DNA occurring via the methylation of cytosine, typically in the context of the CpG dinucleotide.

DNA methyltransferases (DNMTs)

Enzymes that establish and maintain DNA methylation using methyl-group donor compounds or cofactors. The main mammalian DNMTs are DNMT1, which maintains methylation state across DNA replication, and DNMT3a and DNMT3b, which perform de novo methylation.

Epigenetics

The study of heritable changes in gene expression or cellular phenotype caused by mechanisms other than changes in the underlying DNA sequence. Epigenetic marks include covalent DNA modifications and posttranslational histone modifications.

Epigenome

The genome-wide distribution of epigenetic marks.

Gene

A specific deoxyribonucleic acid (DNA) sequence that codes for a specific polypeptide or protein or an observable inherited trait.

Genome-wide association study (GWAS)

A study that maps DNA polymorphisms in affected individuals and controls matched for age, sex, and ethnic background with the aim of identifying causal genetic variants.

Genotype

The DNA content of a cell's nucleus, whether a trait is externally observable or not.

Histone acetyltransferases (HATs) and histone deacetylases (HDACs)

HATs are enzymes that transfer acetyl groups to specific positions on histone tails, promoting an “open” chromatin state and transcriptional activation. HDACs remove these acetyl groups, resulting in a “closed” chromatin state and transcriptional repression.

Histone modifications

Posttranslational modifications of the N-terminal “tails” of histone proteins that serve as a major mode of epigenetic regulation. These modifications include acetylation, phosphorylation, methylation, sumoylation, ubiquitination, and ADP-ribosylation.

Identical twins

Two individual organisms that originated from the same zygote and therefore are genetically identical or very similar. The epigenetic profiling of identical twins discordant for disease is a unique experimental design as it eliminates the DNA sequence-, age-, and sex-differences from consideration.

Phenotype

The pattern of expression of the genotype or the magnitude or extent to which it is observably expressed—an observable characteristic or trait of an

organism, such as its morphology, development, biochemical or physiological properties, or behavior.

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9. Evolutionary Theories in Psychology

Original chapter by David M. Buss adapted by the Queen's Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen’s Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

Evolution or change over time occurs through the processes of natural and sexual selection. In response to problems in our environment, we adapt both physically and psychologically to ensure our survival and reproduction. Sexual selection theory describes how evolution has shaped us to provide a mating advantage rather than just a survival advantage and occurs through two distinct pathways: intrasexual competition and intersexual selection. Gene selection theory, the modern explanation behind evolutionary biology, occurs through the desire for gene replication. Evolutionary psychology connects evolutionary principles with modern psychology and focuses primarily on psychological adaptations: changes in the way we think in order to improve our survival. Two major evolutionary psychological theories are described: Sexual strategies theory describes the psychology of human mating strategies and the ways in which women and men differ in those strategies. Error management theory describes the evolution of biases in the way we think about everything.

Learning Objectives

- Learn what “evolution” means.
- Define the primary mechanisms by which evolution takes place.
- Identify the two major classes of adaptations.
- Define sexual selection and its two primary processes.
- Define gene selection theory.
- Understand psychological adaptations.
- Identify the core premises of sexual strategies theory.
- Identify the core premises of error management theory, and provide two empirical examples of adaptive cognitive biases.

Introduction

If you have ever been on a first date, you're probably familiar with the anxiety of trying to figure out what clothes to wear or what perfume or cologne to put on. In fact, you may even consider flossing your teeth for the first time all year. When considering why you put in all this work, you probably recognize that you're doing it to impress the other person. But how did you learn these particular behaviors? Where did you get the idea that a first date



It may seem like just a casual date, but don't doubt that the forces of evolution are hard at work below the surface. [Image: Best Couples, <https://goo.gl/aBM6W>, CC BY-SA 2.0, <https://goo.gl/jSSrcO>]

should be at a nice restaurant or someplace unique? It is possible that we have been taught these behaviors by observing others. It is also possible, however, that these behaviors—the fancy clothes, the expensive restaurant—are biologically programmed into us. That is, just as peacocks display their feathers to show how attractive they are, or some lizards do push-ups to show how strong they are, when we style our hair or bring a gift to a date, we're trying to communicate to the other person: "Hey, I'm a good mate! Choose me! Choose me!"

However, we all know that our ancestors hundreds of thousands of years ago weren't driving sports cars or wearing designer clothes to attract mates. So how could someone ever say that such behaviors are "biologically programmed" into us? Well, even though our ancestors might not have been doing these specific actions, these behaviors are the result of the same driving force: the powerful influence of **evolution**. Yes, evolution—certain traits and behaviors developing over time because they are advantageous to our survival. In the case of dating, doing something like offering a gift might represent more than a nice gesture. Just as chimpanzees will give food to mates to show they can provide for them, when you offer gifts to your dates, you are communicating that you have the money or "resources" to help take care of them. And even though the person receiving the gift may not realize it, the same evolutionary forces are influencing his or her behavior as well. The receiver of the gift evaluates not only the gift but also the gift-giver's clothes, physical appearance, and many other qualities, to determine whether the individual is a suitable mate. But because these evolutionary processes are hardwired into us, it is easy to overlook their influence.

To broaden your understanding of evolutionary processes, this module will present some of the most important elements of evolution as they impact psychology. Evolutionary theory helps us piece together the story of how we humans have

prospered. It also helps to explain why we behave as we do on a daily basis in our modern world: why we bring gifts on dates, why we get jealous, why we crave our favorite foods, why we protect our children, and so on. Evolution may seem like a historical concept that applies only to our ancient ancestors but, in truth, it is still very much a part of our modern daily lives.

Basics of Evolutionary Theory

Evolution simply means change over time. Many think of evolution as the development of traits and behaviors that allow us to survive this “dog-eat-dog” world, like strong leg muscles to run fast, or fists to punch and defend ourselves. However, physical survival is only important if it eventually contributes to successful reproduction. That is, even if you live to be a 100-year-old, if you fail to mate and produce children, your genes will die with your body. Thus, *reproductive* success, not *survival* success, is the engine of evolution by **natural selection**. Every mating success by one person means the loss of a mating opportunity for another. Yet every living human being is an evolutionary success story. Each of us is descended from a long and unbroken line of ancestors who triumphed over others in the struggle to survive (at least long enough to mate) and reproduce. However, in order for our genes to endure over time—to survive harsh climates, to defeat predators—we have inherited adaptive, psychological processes designed to ensure success.

At the broadest level, we can think of organisms, including humans, as having two large classes of **adaptations**—or traits and behaviors that evolved over time to increase our reproductive success. The first class of adaptations are called survival adaptations: mechanisms that helped our ancestors handle the “hostile forces of nature.” For example, in order to survive very hot temperatures, we developed sweat glands to

cool ourselves. In order to survive very cold temperatures, we developed shivering mechanisms (the speedy contraction and expansion of muscles to produce warmth). Other examples of survival adaptations include developing a craving for fats and sugars, encouraging us to seek out particular foods rich in fats and sugars that keep us going longer during food shortages. Some threats, such as snakes, spiders, darkness, heights, and strangers, often produce fear in us, which encourages us to avoid them and thereby stay safe. These are also examples of survival adaptations. However, all of these adaptations are for physical *survival*, whereas the second class of adaptations are for *reproduction*, and help us compete for mates. These adaptations are described in an evolutionary theory proposed by Charles Darwin, called **sexual selection** theory.

Sexual Selection Theory

Darwin noticed that there were many traits and behaviors of organisms that could not be explained by “survival selection.” For example, the brilliant plumage of peacocks should actually lower their rates of survival. That is, the peacocks’ feathers act like a neon sign to predators, advertising “Easy, delicious dinner here!” But if these bright feathers only lower peacocks’ chances at survival, why do they have them? The same can be asked of similar characteristics of other animals, such as the large antlers of male stags or the wattles of roosters, which also seem to be unfavorable to survival. Again, if these traits only make the animals less likely to survive, why did they develop in the first place? And how have these animals continued to survive with these traits over thousands and thousands of years? Darwin’s answer to this conundrum was the theory of sexual selection: the evolution of characteristics, not because of survival advantage, but because of *mating* advantage.

Sexual selection occurs through two processes. The first, intrasexual competition, occurs when members of one sex compete against each other, and the winner gets to mate with a member of the opposite sex. Male stags, for example, battle with their antlers, and the winner (often the stronger one with larger antlers) gains mating access to the female. That is, even though large antlers make it harder for the stags to run through the



Modern sports like boxing can be seen as modified/stylized versions of the evolutionary behavior of intrasexual competition. [Image: Dave Hogg, <https://goo.gl/fL5U2Z>, CC BY 2.0, <https://goo.gl/9uSnqN>]

forest and evade predators (which lowers their survival success), they provide the stags with a better chance of attracting a mate (which increases their reproductive success). Similarly, human males sometimes also compete against each other in physical contests: boxing, wrestling, karate, or group-on-group sports, such as football. Even though engaging in these activities poses a “threat” to their survival success, as with the stag, the victors are often more attractive to potential mates, increasing their reproductive success. Thus, whatever qualities lead to success in **intrasexual competition** are then passed on with greater frequency due to their association with greater mating success.

The second process of sexual selection is preferential mate choice, also called **intersexual selection**. In this process, if members of one sex are attracted to certain qualities in mates—such as brilliant plumage, signs of good health, or even intelligence—those desired qualities get passed on in greater numbers, simply because their possessors mate more often. For example, the colorful plumage of peacocks exists due to

a long evolutionary history of peahens' (the term for female peacocks) attraction to males with brilliantly colored feathers.

In all sexually-reproducing species, adaptations in both sexes (males and females) exist due to survival selection and sexual selection. However, unlike other animals where one sex has dominant control over mate choice, humans have “mutual mate choice.” That is, both women and men typically have a say in choosing their mates. And both mates value qualities such as kindness, intelligence, and dependability that are beneficial to long-term relationships—qualities that make good partners and good parents.

Gene Selection Theory

In modern evolutionary theory, all evolutionary processes boil down to an organism's genes. Genes are the basic “units of heredity,” or the information that is passed along in DNA that tells the cells and molecules how to “build” the organism and how that organism should behave. Genes that are better able to encourage the organism to reproduce, and thus replicate themselves in the organism's offspring, have an advantage over competing genes that are less able. For example, take female sloths: In order to attract a mate, they will scream as loudly as they can, to let potential mates know where they are in the thick jungle. Now, consider two types of genes in female sloths: one gene that allows them to scream extremely loudly, and another that only allows them to scream moderately loudly. In this case, the sloth with the gene that allows her to shout louder will attract more mates—increasing reproductive success—which ensures that her genes are more readily passed on than those of the quieter sloth.

Essentially, genes can boost their own replicative success in two basic ways. First, they can influence the odds for survival and reproduction of the organism they are in (individual

reproductive success or fitness—as in the example with the sloths). Second, genes can also influence the organism to help other organisms who also likely contain those genes—known as “genetic relatives”—to survive and reproduce (which is called inclusive fitness). For example, why do human parents tend to help their own kids with the financial burdens of a college education and not the kids next door? Well, having a college education increases one’s attractiveness to other mates, which increases one’s likelihood for reproducing and passing on genes. And because parents’ genes are in their own children (and not the neighborhood children), funding their children’s educations increases the likelihood that the parents’ genes will be passed on.

Understanding gene replication is the key to understanding modern evolutionary theory. It also fits well with many evolutionary psychological theories. However, for the time being, we’ll ignore genes and focus primarily on actual adaptations that evolved because they helped our ancestors survive and/or reproduce.

Evolutionary Psychology

Evolutionary psychology aims the lens of modern evolutionary theory on the workings of the human mind. It focuses primarily on **psychological adaptations**: mechanisms of the mind that have evolved to solve specific problems of survival or reproduction. These kinds of adaptations are in contrast to *physiological* adaptations, which are adaptations that occur in the body as a consequence of one’s environment. One example of a physiological adaptation is how our skin makes calluses. First, there is an “input,” such as repeated friction to the skin on the bottom of our feet from walking. Second, there is a “procedure,” in which the skin grows new skin cells at the afflicted area. Third, an actual callus forms as an “output” to

protect the underlying tissue—the final outcome of the physiological adaptation (i.e., tougher skin to protect repeatedly scraped areas). On the other hand, a *psychological* adaptation is a development or change of a mechanism in the mind. For example, take sexual jealousy. First, there is an “input,” such as a romantic partner flirting with a rival. Second, there is a “procedure,” in which the person evaluates the threat the rival poses to the romantic relationship. Third, there is a behavioral output, which might range from vigilance (e.g., snooping through a partner’s email) to violence (e.g., threatening the rival).

Evolutionary psychology is fundamentally an *interactionist* framework, or a theory that takes into account multiple factors when determining the outcome. For example, jealousy, like a callus, doesn’t simply pop up out of nowhere. There is an “interaction” between the environmental trigger (e.g., the flirting; the repeated rubbing of the skin) and the initial response (e.g., evaluation of the flirter’s threat; the forming of new skin cells) to produce the outcome.

In evolutionary psychology, culture also has a major effect on psychological adaptations. For example, status within one’s group is important in all cultures for achieving reproductive success, because higher status makes someone more attractive to mates. In individualistic cultures, such as the United States, status is heavily determined by individual accomplishments. But in more collectivist cultures, such as Japan, status is more heavily determined by contributions to the group and by that group’s success. For example, consider a group project. If you were to put in most of the effort on a successful group project, the culture in the United States reinforces the psychological adaptation to try to claim that success for yourself (because individual achievements are rewarded with higher status). However, the culture in Japan reinforces the psychological adaptation to attribute that success to the whole group (because collective achievements

are rewarded with higher status). Another example of cultural input is the importance of virginity as a desirable quality for a mate. Cultural norms that advise against premarital sex persuade people to ignore their own basic interests because they know that virginity will make them more attractive marriage partners. Evolutionary psychology, in short, does not predict rigid robotic-like “instincts.” That is, there isn’t one rule that works all the time. Rather, evolutionary psychology studies flexible, environmentally-connected and culturally-influenced adaptations that vary according to the situation.

Psychological adaptations are hypothesized to be wide-ranging, and include food preferences, habitat preferences, mate preferences, and specialized fears. These psychological adaptations also include many traits that improve people’s ability to live in groups, such as the desire to cooperate and make friends, or the inclination to spot and avoid frauds, punish rivals, establish status hierarchies, nurture children, and help genetic relatives. Research programs in evolutionary psychology develop and empirically test predictions about the nature of psychological adaptations. Below, we highlight a few evolutionary psychological theories and their associated research approaches.

Sexual Strategies Theory

Sexual strategies theory is based on sexual selection theory. It proposes that humans have evolved a list of different mating strategies, both short-term and long-term, that vary depending on culture, social context, parental influence, and personal mate value (desirability in the “mating market”).

In its initial formulation, sexual strategies theory focused on the differences between men and women in mating preferences and strategies (**Buss & Schmitt, 1993**). It started by looking at the minimum parental investment needed to

produce a child. For women, even the minimum investment is significant: after becoming pregnant, they have to carry that child for nine months inside of them. For men, on the other hand, the minimum investment to produce the same child is considerably smaller—simply the act of sex.

These differences in parental investment have an enormous impact on sexual strategies. For a woman, the risks associated with making a poor mating choice is high. She might get pregnant by a man who will not help to support her and her children, or who might have poor-quality genes. And because the stakes are higher for a woman, wise mating decisions for her are much more valuable. For men, on the other hand, the need to



Because women bear responsibility for pregnancy, they may use different sexual selection strategies than men do. [Image: CC0 Public Domain, <https://goo.gl/m25gce>]

focus on making wise mating decisions isn't as important. That is, unlike women, men 1) don't biologically have the child growing inside of them for nine months, and 2) do not have as high a cultural expectation to raise the child. This logic leads to a powerful set of predictions: In short-term mating, women will likely be choosier than men (because the costs of getting pregnant are so high), while men, on average, will likely engage in more casual sexual activities (because this cost is greatly lessened). Due to this, men will sometimes deceive women about their long-term intentions for the benefit of short-term sex, and men are more likely than women to lower their mating standards for short-term mating situations.

An extensive body of empirical evidence supports these and related predictions (**Buss & Schmitt, 2011**). Men express a desire

for a larger number of sex partners than women do. They let less time elapse before seeking sex. They are more willing to consent to sex with strangers and are less likely to require emotional involvement with their sex partners. They have more frequent sexual fantasies and fantasize about a larger variety of sex partners. They are more likely to regret missed sexual opportunities. And they lower their standards in short-term mating, showing a willingness to mate with a larger variety of women as long as the costs and risks are low.

However, in situations where both the man and woman are interested in long-term mating, both sexes tend to invest substantially in the relationship and in their children. In these cases, the theory predicts that both sexes will be extremely choosy when pursuing a long-term mating strategy. Much empirical research supports this prediction, as well. In fact, the qualities women and men generally look for when choosing long-term mates are very similar: both want mates who are intelligent, kind, understanding, healthy, dependable, honest, loyal, loving, and adaptable.

Nonetheless, women and men do differ in their preferences for a few key qualities in long-term mating, because of somewhat distinct adaptive problems. Modern women have inherited the evolutionary trait to desire mates who possess resources, have qualities linked with acquiring resources (e.g., ambition, wealth, industriousness), and are willing to share those resources with them. On the other hand, men more strongly desire youth and health in women, as both are cues to fertility. These male and female differences are universal in humans. They were first documented in 37 different cultures, from Australia to Zambia (**Buss, 1989**), and have been replicated by dozens of researchers in dozens of additional cultures (for summaries, see (**Perilloux, Easton, & Buss, 2012**)).

As we know, though, just because we have these mating preferences (e.g., men with resources; fertile women), people don't always get what they want. There are countless other

factors which influence who people ultimately select as their mate. For example, the sex ratio (the percentage of men to women in the mating pool), cultural practices (such as arranged marriages, which inhibit individuals' freedom to act on their preferred mating strategies), the strategies of others (e.g., if everyone else is pursuing short-term sex, it's more difficult to pursue a long-term mating strategy), and many others all influence who we select as our mates.

Sexual strategies theory—anchored in sexual selection theory— predicts specific similarities and differences in men and women's mating preferences and strategies. Whether we seek short-term or long-term relationships, many personality, social, cultural, and ecological factors will all influence who our partners will be.

Error Management Theory



If you were walking in the woods and heard a sound in the bushes you might be startled and act on the worst case scenario—such as the threat of a wild animal—by moving in the opposite direction. This is evolutionary psychology at work, keeping you safe so you can survive and reproduce. [Image: Nicholas T, <https://goo.gl/gZ3zEL>, CC BY 2.0, <https://goo.gl/9uSnqN>]

Error management theory (EMT) deals with the evolution of how we think, make decisions, and evaluate uncertain situations—that is, situations where there's no clear answer how we should behave. Consider, for example, walking through the woods at dusk. You hear a rustle in the leaves on the path in front of you. It could be a snake. Or, it could just be the wind blowing the leaves. Because you can't really tell why the leaves rustled, it's an uncertain situation. The important question then is, what are the costs of errors in

judgment? That is, if you conclude that it's a dangerous snake so you avoid the leaves, the costs are minimal (i.e., you simply make a short detour around them). However, if you assume the leaves are safe and simply walk over them—when in fact it *is* a dangerous snake—the decision could cost you your life.

Now, think about our evolutionary history and how generation after generation was confronted with similar decisions, where one option had low cost but great reward (walking around the leaves and not getting bitten) and the other had a low reward but high cost (walking through the leaves and getting bitten). These kinds of choices are called “cost asymmetries.” If during our evolutionary history we encountered decisions like these generation after generation, over time an adaptive bias would be created: we would make

sure to err in favor of the least costly (in this case, least dangerous) option (e.g., walking around the leaves). To put it another way, EMT predicts that whenever uncertain situations present us with a safer versus more dangerous decision, we will psychologically adapt to prefer choices that minimize the cost of errors.

EMT is a general evolutionary psychological theory that can be applied to many different domains of our lives, but a specific example of it is the *visual descent illusion*. To illustrate: Have you ever thought it would be no problem to jump off of a ledge, but as soon as you stood up there, it suddenly looked much higher than you thought? The visual descent illusion (**Jackson & Cormack, 2008**) states that people will overestimate the distance when looking down from a height (compared to looking up) so that people will be especially wary of falling from great heights—which would result in injury or death. Another example of EMT is the *auditory looming bias*: Have you ever noticed how an ambulance seems closer when it's coming toward you, but suddenly seems far away once it's immediately passed? With the auditory looming bias, people overestimate how close objects are when the sound is moving toward them compared to when it is moving away from them. From our evolutionary history, humans learned, "It's better to be safe than sorry." Therefore, if we think that a threat is closer to us when it's moving toward us (because it seems louder), we will be quicker to act and escape. In this regard, there may be times we ran away when we didn't need to (a false alarm), but wasting that time is a less costly mistake than not acting in the first place when a real threat does exist.

EMT has also been used to predict adaptive biases in the domain of mating. Consider something as simple as a smile. In one case, a smile from a potential mate could be a sign of sexual or romantic interest. On the other hand, it may just signal friendliness. Because of the costs to men of missing out on chances for reproduction, EMT predicts that men have a

sexual overperception bias: they often misread sexual interest from a woman, when really it's just a friendly smile or touch. In the mating domain, the sexual overperception bias is one of the best-documented phenomena. It's been shown in studies in which men and women rated the sexual interest between people in photographs and videotaped interactions. As well, it's been shown in the laboratory with participants engaging in actual "speed dating," where the men interpret sexual interest from the women more often than the women actually intended it (**Perilloux, Easton, & Buss, 2012**). In short, EMT predicts that men, more than women, will over-infer sexual interest based on minimal cues, and empirical research confirms this adaptive mating bias.

Sexual strategies theory and error management theory are two evolutionary psychological theories that have received much empirical support from dozens of independent researchers. But, there are many other evolutionary psychological theories, such as social exchange theory for example, that also make predictions about our modern day behavior and preferences, too. The merits of each evolutionary psychological theory, however, must be evaluated separately and treated like any scientific theory. That is, we should only trust their predictions and claims to the extent they are supported by scientific studies. However, even if the theory is scientifically grounded, just because a psychological adaptation was advantageous in our history, it doesn't mean it's still useful today. For example, even though women may have preferred men with resources in generations ago, our modern society has advanced such that these preferences are no longer apt or necessary. Nonetheless, it's important to consider how our evolutionary history has shaped our automatic or "instinctual" desires and reflexes of today, so that we can better shape them for the future ahead.

Where Does Evolutionary Psychology Stand Today?

This chapter places a focus on heteronormative relationships with the purpose of sexual reproduction. What about relationships that are not heteronormative? We are lucky to have Dr. Sari van Anders as part of our department, and in this video, Dr. van Anders addresses this important question:



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This is a large area of research. If you are interested in learning more, the Queen's University Department of Psychology offers courses including Human Sexuality, Sexuality & Gender, and Gender, Hormones, & Behaviour.

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Vocabulary

Adaptations

Evolved solutions to problems that historically contributed to reproductive success.

Error management theory (EMT)

A theory of selection under conditions of uncertainty in which recurrent cost asymmetries of judgment or inference favor the evolution of adaptive cognitive biases that function to minimize the more costly errors.

Evolution

Change over time. Is the definition changing?

Gene Selection Theory

The modern theory of evolution by selection by which differential gene replication is the defining process of evolutionary change.

Intersexual selection

A process of sexual selection by which evolution (change) occurs as a consequences of the mate preferences of one sex exerting selection pressure on members of the opposite sex.

Intrasexual competition

A process of sexual selection by which members of one sex compete with each other, and the victors gain preferential mating access to members of the opposite sex.

Natural selection

Differential reproductive success as a consequence of differences in heritable attributes.

Psychological adaptations

Mechanisms of the mind that evolved to solve specific problems of survival or reproduction; conceptualized as information processing devices.

Sexual selection

The evolution of characteristics because of the mating advantage they give organisms.

Sexual strategies theory

A comprehensive evolutionary theory of human mating that defines the menu of mating strategies humans pursue (e.g., short-term casual sex, long-term committed mating), the adaptive problems women and men face when pursuing these strategies, and the evolved solutions to these mating problems.

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10. The Nature-Nurture Question

Original chapter by Eric Turkheimer
adapted by the Queen's University
Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

People have a deep intuition about what has been called the “nature–nurture question.” Some aspects of our behavior feel as though they originate in our genetic makeup, while others feel like the result of our upbringing or our own hard work. The scientific field of behavior genetics attempts to study these differences empirically, either by examining similarities among family members with different degrees of genetic relatedness, or, more recently, by studying differences in the DNA of people with different behavioral traits. The scientific methods that have been developed are ingenious, but often inconclusive. Many of the difficulties encountered in the empirical science of behavior genetics turn out to be conceptual, and our intuitions about nature and nurture get more complicated the harder we think about them. In the end, it is an oversimplification to ask how “genetic” some particular behavior is. Genes and environments always combine to produce behavior, and the

real science is in the discovery of how they combine for a given behavior.

Learning Objectives

- Understand what the nature–nurture debate is and why the problem fascinates us.
- Understand why nature–nurture questions are difficult to study empirically.
- Know the major research designs that can be used to study nature–nurture questions.
- Appreciate the complexities of nature–nurture and why questions that seem simple turn out not to have simple answers.

Introduction

There are three related problems at the intersection of philosophy and science that are fundamental to our understanding of our relationship to the natural world: the mind–body problem, the free will problem, and the nature–nurture problem. These great questions have a lot in common. Everyone, even those without much knowledge of science or philosophy, has opinions about the answers to these questions that come simply from observing the world we live in. Our feelings about our relationship with the physical and biological world often seem incomplete. We are in control of our actions in some ways, but at the mercy of our bodies in others; it feels obvious that our consciousness is some kind of creation of our physical brains, at the same time we sense that our awareness must go beyond just the physical. This incomplete knowledge of our relationship with nature leaves

us fascinated and a little obsessed, like a cat that climbs into a paper bag and then out again, over and over, mystified every time by a relationship between inner and outer that it can see but can't quite understand.

It may seem obvious that we are born with certain characteristics while others are acquired, and yet of the three great questions about humans' relationship with the natural world, only nature–nurture gets referred to as a “debate.” In the history of psychology, no other question has caused so much controversy and offense: We are so concerned with nature–nurture because our very sense of moral character seems to depend on it. While we may admire the athletic skills of a great basketball player, we think of his height as simply a gift, a payoff in the “genetic lottery.” For the same reason, no one blames a short person for his height or someone's congenital disability on poor decisions: To state the obvious, it's “not their fault.” But we do praise the concert violinist (and perhaps her parents and teachers as well) for her dedication, just as we condemn cheaters, slackers, and bullies for their bad behavior.

The problem is, most human characteristics aren't usually as clear-cut as height or instrument-mastery, affirming our nature–nurture expectations strongly one way or the other. In fact, even the great violinist might have some inborn qualities—perfect pitch, or long, nimble fingers—that support and reward her hard work. And the basketball player might have eaten a diet while growing up that promoted his genetic tendency for being tall. When we think about our own qualities, they seem under our control in some respects, yet beyond our control in others. And often the traits that don't seem to have an obvious cause are the ones that concern us the most and are far more personally significant. What about how much we drink or worry? What about our honesty, or religiosity, or sexual orientation? They all come from that

uncertain zone, neither fixed by nature nor totally under our own control.



Researchers have learned a great deal about the nature-nurture dynamic by working with animals. But of course many of the techniques used to study animals cannot be applied to people. Separating these two influences in human subjects is a greater research challenge. [Image: Sebastián Dario, <https://goo.gl/OPIIWd>, CC BY-NC 2.0, <https://goo.gl/Filc2e>]

One major problem with answering nature-nurture questions about people is, how do you set up an experiment? In nonhuman animals, there are relatively straightforward experiments for tackling nature–nurture questions. Say, for example, you are interested in aggressiveness in dogs. You want to test for the more important determinant of aggression: being born to aggressive dogs or being raised by them. You could mate two aggressive dogs—angry Chihuahuas—together, and mate two nonaggressive

dogs—happy beagles—together, then switch half the puppies from each litter between the different sets of parents to raise. You would then have puppies born to aggressive parents (the Chihuahuas) but being raised by nonaggressive parents (the Beagles), and vice versa, in litters that mirror each other in puppy distribution. The big questions are: Would the Chihuahua parents raise aggressive beagle puppies? Would the beagle parents raise *nonaggressive* Chihuahua puppies? Would the puppies' *nature* win out, regardless of who raised them? Or... would the result be a combination of nature *and* nurture? Much of the most significant nature–nurture research has been done in this way (**Scott & Fuller, 1998**), and animal

breeders have been doing it successfully for thousands of years. In fact, it is fairly easy to breed animals for behavioral traits.

With people, however, we can't assign babies to parents at random, or select parents with certain behavioral characteristics to mate, merely in the interest of science (though history does include horrific examples of such practices, in misguided attempts at "eugenics," the shaping of human characteristics through intentional breeding). In typical human families, children's biological parents raise them, so it is very difficult to know whether children act like their parents due to genetic (nature) or environmental (nurture) reasons. Nevertheless, despite our restrictions on setting up human-based experiments, we do see real-world examples of nature-nurture at work in the human sphere—though they only provide partial answers to our many questions.

The science of how genes and environments work together to influence behavior is called **behavioral genetics**. The easiest opportunity we have to observe this is the **adoption study**. When children are put up for adoption, the parents who give birth to them are no longer the parents who raise them. This setup isn't quite the same as the experiments with dogs (children aren't assigned to random adoptive parents in order to suit the particular interests of a scientist) but adoption still tells us some interesting things, or at least confirms some basic expectations. For instance, if the biological child of tall parents were adopted into a family of short people, do you suppose the child's growth would be affected? What about the biological child of a Spanish-speaking family adopted at birth into an English-speaking family? What language would you expect the child to speak? And what might these outcomes tell you about the difference between height and language in terms of nature-nurture?

Another option for observing nature-nurture in humans involves **twin studies**. There are two types of twins: monozygotic (MZ) and dizygotic (DZ). Monozygotic twins, also called “identical” twins, result from a single zygote (fertilized egg) and have the same DNA. They are essentially clones. Dizygotic twins, also known as “fraternal” twins, develop from two zygotes and share 50% of their DNA. Fraternal twins are ordinary siblings



Studies focused on twins have led to important insights about the biological origins of many personality characteristics.

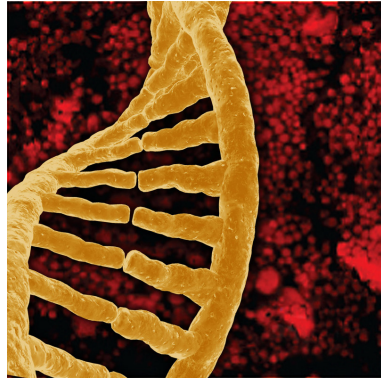
who happen to have been born at the same time. To analyze nature–nurture using twins, we compare the similarity of MZ and DZ pairs. Sticking with the features of height and spoken language, let’s take a look at how nature and nurture apply: Identical twins, unsurprisingly, are almost perfectly similar for height. The heights of fraternal twins, however, are like any other sibling pairs: more similar to each other than to people from other families, but hardly identical. This contrast between twin types gives us a clue about the role genetics plays in determining height. Now consider spoken language. If one identical twin speaks Spanish at home, the co-twin with whom she is raised almost certainly does too. But the same would be true for a pair of fraternal twins raised together. In terms of spoken language, fraternal twins are just as similar as identical twins, so it appears that the genetic match of identical twins doesn’t make much difference.

Twin and adoption studies are two instances of a much broader class of methods for observing nature-nurture called

quantitative genetics, the scientific discipline in which similarities among individuals are analyzed based on how biologically related they are. We can do these studies with siblings and half-siblings, cousins, twins who have been separated at birth and raised separately (**Bouchard, Lykken, McGue, & Segal, 1990**; such twins are very rare and play a smaller role than is commonly believed in the science of nature–nurture), or with entire extended families (see **Plomin, DeFries, Knopik, & Neiderhiser, 2012**, for a complete introduction to research methods relevant to nature–nurture).

For better or for worse, contentions about nature–nurture have intensified because quantitative genetics produces a number called a **heritability coefficient**, varying from 0 to 1, that is meant to provide a single measure of genetics' influence of a trait. In a general way, a heritability coefficient measures how strongly differences among individuals are related to differences among their genes. But beware: Heritability coefficients, although simple to compute, are deceptively difficult to interpret. Nevertheless, numbers that provide simple answers to complicated questions tend to have a strong influence on the human imagination, and a great deal of time has been spent discussing whether the heritability of intelligence or personality or depression is equal to one number or another.

One reason nature–nurture continues to fascinate us so much is that we live in an era of great scientific discovery in genetics, comparable to the times of Copernicus, Galileo, and Newton, with regard to astronomy and physics. Every day, it seems, new discoveries are made, new possibilities proposed. When Francis Galton first started thinking about nature–nurture in the late-19th century he was very influenced by his cousin, Charles Darwin, but genetics *per se* was unknown. Mendel’s famous work with peas, conducted at about the same time, went



Quantitative genetics uses statistical methods to study the effects that both heredity and environment have on test subjects. These methods have provided us with the heritability coefficient which measures how strongly differences among individuals for a trait are related to differences among their genes. [Image: EMSL, <https://goo.gl/IRfn9g>, CC BY-NC-SA 2.0, <https://goo.gl/fbv27n>]

undiscovered for 20 years; quantitative genetics was developed in the 1920s; DNA was discovered by Watson and Crick in the 1950s; the human genome was completely sequenced at the turn of the 21st century; and we are now on the verge of being able to obtain the specific DNA sequence of anyone at a relatively low cost. No one knows what this new genetic knowledge will mean for the study of nature–nurture, but as we will see in the next section, answers to nature–nurture questions have turned out to be far more difficult and mysterious than anyone imagined.

What Have We Learned About Nature–Nurture?

It would be satisfying to be able to say that nature–nurture studies have given us conclusive and complete evidence about where traits come from, with some traits clearly resulting from genetics and others almost entirely from environmental factors, such as childrearing practices and personal will; but that is not the case. Instead, *everything* has turned out to have some footing in genetics. The more genetically-related people are, the more similar they are—for *everything*: height, weight, intelligence, personality, mental illness, etc. Sure, it seems like common sense that some traits have a genetic bias. For example, adopted children resemble their biological parents even if they have never met them, and identical twins are more similar to each other than are fraternal twins. And while certain psychological traits, such as personality or mental illness (e.g., schizophrenia), seem reasonably influenced by genetics, it turns out that the same is true for political attitudes, how much television people watch (**Plomin, Corley, DeFries, & Fulker, 1990**), and whether or not they get divorced (**McGue & Lykken, 1992**).



Research over the last half century has revealed how central genetics are to behavior. The more genetically related people are the more similar they are not just physically but also in terms of personality and behavior. [Image: Paul Altobelli, <https://goo.gl/SWLwm2>, CC BY 2.0, <https://goo.gl/9uSnqNJ>]

It may seem surprising, but genetic influence on behavior is a relatively recent discovery. In the middle of the 20th century, psychology was dominated by the doctrine of behaviorism, which held that behavior could only be explained in terms of environmental factors.

Psychiatry concentrated on psychoanalysis, which probed for roots of behavior in individuals' early life-histories. The truth is, neither behaviorism nor psychoanalysis is incompatible with genetic

influences on behavior, and neither Freud nor Skinner was naive about the importance of organic processes in behavior. Nevertheless, in their day it was widely thought that children's personalities were shaped entirely by imitating their parents' behavior, and that schizophrenia was caused by certain kinds of "pathological mothering." Whatever the outcome of our broader discussion of nature–nurture, the basic fact that the best predictors of an adopted child's personality or mental health are found in the biological parents he or she has never met, rather than in the adoptive parents who raised him or her, presents a significant challenge to purely environmental explanations of personality or psychopathology. The message is clear: You can't leave genes out of the equation. But keep in mind, no behavioral traits are completely inherited, so you can't leave the environment out altogether, either.

Trying to untangle the various ways nature-nurture

influences human behavior can be messy, and often common-sense notions can get in the way of good science. One very significant contribution of behavioral genetics that has changed psychology for good can be very helpful to keep in mind: When your subjects are biologically-related, no matter how clearly a situation may seem to point to environmental influence, it is never safe to interpret a behavior as wholly the result of nurture without further evidence. For example, when presented with data showing that children whose mothers read to them often are likely to have better reading scores in third grade, it is tempting to conclude that reading to your kids out loud is important to success in school; this may well be true, but the study as described is inconclusive, because there are genetic *as well as* environmental pathways between the parenting practices of mothers and the abilities of their children. This is a case where “correlation does not imply causation,” as they say. To establish that reading aloud causes success, a scientist can either study the problem in adoptive families (in which the genetic pathway is absent) or by finding a way to randomly assign children to oral reading conditions.

The outcomes of nature–nurture studies have fallen short of our expectations (of establishing clear-cut bases for traits) in many ways. The most disappointing outcome has been the inability to organize traits from *more–* to *less–*genetic. As noted earlier, everything has turned out to be at least *somewhat* heritable (passed down), yet nothing has turned out to be *absolutely* heritable, and there hasn’t been much consistency as to which traits are *more* heritable and which are *less* heritable once other considerations (such as how accurately the trait can be measured) are taken into account (**Turkheimer, 2000**). The problem is conceptual: The heritability coefficient, and, in fact, the whole quantitative structure that underlies it, does not match up with our nature–nurture intuitions. We want to know how “important” the roles of genes and environment are to the development of a trait, but in focusing

on “important” maybe we’re emphasizing the wrong thing. First of all, genes and environment are both crucial to every trait; without genes the environment would have nothing to work on, and too, genes cannot develop in a vacuum. Even more important, because nature–nurture questions look at the differences among people, the cause of a given trait depends not only on the trait itself, but also on the differences in that trait between members of the group being studied.

The classic example of the heritability coefficient defying intuition is the trait of having two arms. No one would argue against the development of arms being a biological, genetic process. But fraternal twins are just as similar for “two-armedness” as identical twins, resulting in a heritability coefficient of zero for the trait of having two arms. Normally, according to the heritability model, this result (coefficient of zero) would suggest all nurture, no nature, but we know that’s not the case. The reason this result is not a tip-off that arm development is less genetic than we imagine is because people *do not vary* in the genes related to arm development—which essentially upends the heritability formula. In fact, in this instance, the opposite is likely true: the extent that people differ in arm number is likely the result of accidents and, therefore, environmental. For reasons like these, we always have to be very careful when asking nature–nurture questions, especially when we try to express the answer in terms of a single number. The heritability of a trait is not simply a property of that trait, but a property of the trait in a particular context of relevant genes and environmental factors.

Another issue with the heritability coefficient is that it divides traits’ determinants into two portions—genes and environment—which are then calculated together for the total variability. This is a little like asking how much of the experience of a symphony comes from the horns and how much from the strings; the ways instruments or genes integrate is more complex than that. It turns out to be the case that, for many

traits, genetic differences affect behavior under some environmental circumstances but not others—a phenomenon called gene-environment interaction, or $G \times E$. In one well-known example, Caspi et al. (2002) showed that among maltreated children, those who carried a particular allele of the MAOA gene showed a predisposition to violence and antisocial behavior, while those with other alleles did not. Whereas, in children who had not been maltreated, the gene had no effect. Making matters even more complicated are very recent studies of what is known as epigenetics (see module, “Epigenetics”), a process in which the DNA itself is modified by environmental events, and those genetic changes transmitted to children.

Some common questions about nature–nurture are, how susceptible is a trait to change, how malleable is it, and do we “have a choice” about it? These questions are much more complex than they may seem at first glance. For example, phenylketonuria is an inborn error of metabolism caused by a single gene; it prevents the body from metabolizing phenylalanine. Untreated, it causes intellectual disability and death. But it can be treated effectively by a straightforward environmental intervention: avoiding foods containing phenylalanine. Height seems

like a trait firmly rooted in our nature and unchangeable, but the average height of many populations in Asia and Europe has



The answer to the nature–nurture question has not turned out to be as straightforward as we would like. The many questions we can ask about the relationships among genes, environments, and human traits may have many different answers, and the answer to one tells us little about the answers to the others. [Image: Sundaram Ramaswamy, <https://goo.gl/Bv8lp6>, CC BY 2.0, <https://goo.gl/9uSnqN>]

increased significantly in the past 100 years, due to changes in diet and the alleviation of poverty. Even the most modern genetics has not provided definitive answers to nature–nurture questions. When it was first becoming possible to measure the DNA sequences of individual people, it was widely thought that we would quickly progress to finding the specific genes that account for behavioral characteristics, but that hasn't happened. There are a few rare genes that have been found to have significant (almost always negative) effects, such as the single gene that causes Huntington's disease, or the Apolipoprotein gene that causes early onset dementia in a small percentage of Alzheimer's cases. Aside from these rare genes of great effect, however, the genetic impact on behavior is broken up over many genes, each with very small effects. For most behavioral traits, the effects are so small and distributed across so many genes that we have not been able to catalog them in a meaningful way. In fact, the same is true of environmental effects. We know that extreme environmental hardship causes catastrophic effects for many behavioral outcomes, but fortunately extreme environmental hardship is very rare. Within the normal range of environmental events, those responsible for differences (e.g., why some children in a suburban third-grade classroom perform better than others) are much more difficult to grasp.

The difficulties with finding clear-cut solutions to nature–nurture problems bring us back to the other great questions about our relationship with the natural world: the mind-body problem and free will. Investigations into what we mean when we say we are aware of something reveal that consciousness is not simply the product of a particular area of the brain, nor does choice turn out to be an orderly activity that we can apply to some behaviors but not others. So it is with nature and nurture: What at first may seem to be a straightforward matter, able to be indexed with a single number, becomes more and more complicated the closer we

look. The many questions we can ask about the intersection among genes, environments, and human traits—how sensitive are traits to environmental change, and how common are those influential environments; are parents or culture more relevant; how sensitive are traits to differences in genes, and how much do the relevant genes vary in a particular population; does the trait involve a single gene or a great many genes; is the trait more easily described in genetic or more-complex behavioral terms?—may have different answers, and the answer to one tells us little about the answers to the others.

It is tempting to predict that the more we understand the wide-ranging effects of genetic differences on all human characteristics—especially behavioral ones—our cultural, ethical, legal, and personal ways of thinking about ourselves will have to undergo profound changes in response. Perhaps criminal proceedings will consider genetic background. Parents, presented with the genetic sequence of their children, will be faced with difficult decisions about reproduction. These hopes or fears are often exaggerated. In some ways, our thinking may need to change—for example, when we consider the meaning behind the fundamental American principle that all men are created equal. Human beings differ, and like all evolved organisms they differ genetically. The Declaration of Independence predates Darwin and Mendel, but it is hard to imagine that Jefferson—whose genius encompassed botany as well as moral philosophy—would have been alarmed to learn about the genetic diversity of organisms. One of the most important things modern genetics has taught us is that almost all human behavior is too complex to be nailed down, even from the most complete genetic information, unless we're looking at identical twins. The science of nature and nurture has demonstrated that genetic differences among people are vital to human moral equality, freedom, and self-determination, not opposed to them. As Mordecai Kaplan said about the role of the past in Jewish theology, genetics gets

a vote, not a veto, in the determination of human behavior. We should indulge our fascination with nature–nurture while resisting the temptation to oversimplify it.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Adoption study

A behavior genetic research method that involves comparison of adopted children to their adoptive and biological parents.

Behavioral genetics

The empirical science of how genes and environments combine to generate behavior.

Heritability coefficient

An easily misinterpreted statistical construct that purports to measure the role of genetics in the explanation of differences among individuals.

Quantitative genetics

Scientific and mathematical methods for inferring genetic and environmental processes based on the degree of genetic and environmental similarity among organisms.

Twin studies

A behavior genetic research method that involves comparison of the similarity of identical (monozygotic; MZ) and fraternal (dizygotic; DZ) twins.

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PSYC 100 IV
LEARNING

11. Knowledge Emotions: Feelings that Foster Learning, Exploring, and Reflecting

Original chapter by Paul Silvia adapted by
the Queen's University Psychology
Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen’s Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

When people think of emotions they usually think of the obvious ones, such as happiness, fear, anger, and sadness. This module looks at the knowledge emotions, a family of emotional states that foster learning, exploring, and reflecting. Surprise, interest, confusion, and awe come from events that are unexpected, complicated, and mentally challenging, and they motivate learning in its broadest sense, be it learning over the course of seconds (finding the source of a loud crash, as in surprise) or over a lifetime (engaging with hobbies, pastimes, and intellectual pursuits, as in interest). The module reviews

research on each emotion, with an emphasis on causes, consequences, and individual differences. As a group, the knowledge emotions motivate people to engage with new and puzzling things rather than avoid them. Over time, engaging with new things, ideas, and people broadens someone's experiences and cultivates expertise. The knowledge emotions thus don't gear up the body like fear, anger, and happiness do, but they do gear up the mind—a critical task for humans, who must learn essentially everything that they know.

Learning Objectives

- Identify the four knowledge emotions.
- Describe the patterns of appraisals that bring about these emotions.
- Discuss how the knowledge emotions promote learning.
- Apply the knowledge emotions to enhancing learning and education, and to one's own life.

Introduction

What comes to mind when you think of emotions? It's probably the elation of happiness, the despair of sadness, or the freak-out fright of fear. Emotions such as happiness, anger, sadness, and fear are important emotions, but human emotional experience is vast—people are capable of experiencing a wide range of feelings.

This module considers the **knowledge emotions**, a profoundly important family of emotions associated with learning, exploring, and reflecting. The family of knowledge emotions has four main members: *surprise*, *interest*, *confusion*, and *awe*. These are considered knowledge emotions for two reasons. First, the events that bring them about involve knowledge: These emotions happen when something violates what people expected or believed. Second, these emotions are fundamental to learning: Over time, they build useful knowledge about the world.



The knowledge emotions—surprise, interest, confusion, and awe—are what help to promote learning. For example, if something unusual happens (surprise), you study it to figure out why it happened.
[Image: typexnick, <https://goo.gl/WIJrRR>, CC BY 2.0, <https://goo.gl/BRvSA7>]

Some Background About Emotions

Before jumping into the knowledge emotions, we should consider what emotions do and when emotions happen.

According to **functionalist theories of emotion**, emotions help people manage important tasks (**Keltner & Gross, 1999; Parrott, 2001**). Fear, for example, mobilizes the body to fight or flee; happiness rewards achieving goals and builds attachments to other people. What do knowledge emotions do? As we'll see in detail later, they motivate *learning*, viewed in its broadest sense, during times that the environment is puzzling or erratic. Sometimes the learning is on a short time scale. Surprise, for example, makes people stop what they are doing, pay attention to the surprising thing, and evaluate whether it is dangerous (**Simons, 1996**). After a couple seconds, people have learned what they needed to know and get back to what they were doing. But sometimes the learning takes place over the lifespan. Interest, for example, motivates people to learn about things over days, weeks, and years. Finding something interesting motivates “for its own sake” learning and is probably the major engine of human competence (**Izard, 1977; Silvia, 2006**).

What causes emotions to happen in the first place? Although it usually feels like something in the world—a good hug, a snake slithering across the driveway, a hot-air balloon shaped like a question mark—causes an emotion directly, emotion theories contend that emotions come from how we think about what is happening in the world, not what is literally happening. After all, if things in the world directly caused emotions, everyone would always have the same emotion in response to something. **Appraisal theories** (**Ellsworth & Scherer, 2003; Lazarus, 1991**) propose that each emotion is caused by a group of appraisals, which are evaluations and judgments of what events in the world mean for our goals and well-being: Is this relevant to me? Does it further or hinder my goals? Can I deal with it or do something about it? Did someone do it on purpose? Different emotions come from different answers to these appraisal questions.

With that as a background, in the following sections we'll

consider the nature, causes, and effects of each knowledge emotion. Afterward, we will consider some of their practical implications.

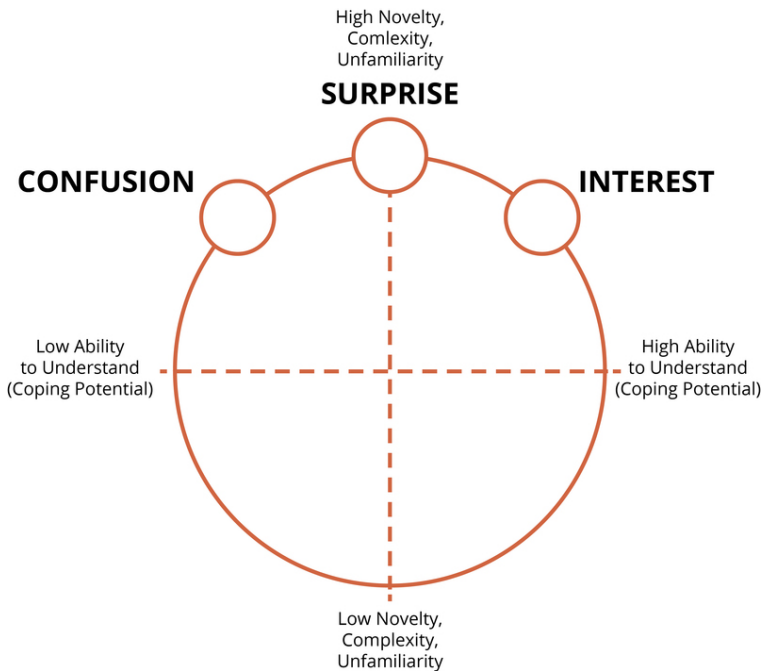


Figure 1. The appraisal space of surprise, interest, and confusion.

Surprise

Nothing gets people’s attention like something startling. **Surprise**, a simple emotion, hijacks a person’s mind and body and focuses them on a source of possible danger (Simons, 1996). When there’s a loud, unexpected crash, people stop, freeze, and orient to the source of the noise. Their minds are wiped clean—after something startling, people usually can’t remember what they had been talking about—and attention

is focused on what just happened. By focusing all the body's resources on the unexpected event, surprise helps people respond quickly (**Simons, 1996**).

Surprise has only one appraisal: A single “expectedness check” (**Scherer, 2001**) seems to be involved. When an event is “high contrast”—it sticks out against the background of what people expected to perceive or experience—people become surprised (**Berlyne, 1960; Teigen & Keren, 2003**). Figure 1 shows this pattern visually: Surprise is high when unexpectedness is high.

Emotions are momentary states, but people vary in their propensity to experience them. Just as some people experience happiness, anger, and fear more readily, some people are much more easily surprised than others. At one end, some people are hard to surprise; at the other end, people are startled by minor noises, flashes, and changes. Like other individual differences in emotion, extreme levels of surprise propensity can be dysfunctional. When people have extreme surprise responses to mundane things—known as hyperstartling (**Simons, 1996**) and hyperekplexia (**Bakker, van Dijk, van den Maagdenberg, & Tijssen, 2006**)—everyday tasks such as driving or swimming become dangerous.

Interest

People are curious creatures. **Interest**—an emotion that motivates exploration and learning (Silvia, 2012)—is one of the most commonly experienced emotions in everyday life (Izard, 1977). Humans must learn virtually everything they know, from how to cook pasta to how the brain works, and interest is an engine of this massive undertaking of learning across the lifespan.



Curiosity, a most familiar emotion, is the reason humans have developed and thrived as they have today. [Image: CCO Public Domain, <https://goo.gl/m25gce>]

The function of interest is to engage people with things that are new, odd, or unfamiliar. Unfamiliar things can be scary or unsettling, which makes people avoid them. But if people always avoided new things they would learn and experience nothing. It's hard to imagine what life would be like if people weren't curious to try new things: We would never feel like watching a different movie, trying a different restaurant, or meeting new people. Interest is thus a counterweight to anxiety—by making unfamiliar things appealing, it motivates people to experience and think about new things. As a result, interest is an **intrinsically motivated** form of learning. When curious, people want to learn something for its own sake, to know it for the simple pleasure of knowing it, not for an external reward, such as learning to get money, impress a peer, or receive the approval of a teacher or parent.

Figure 1 shows the two appraisals that create interest. Like surprise, interest involves appraisals of novelty: Things that are unexpected, unfamiliar, novel, and complex can evoke interest

(Berlyne, 1960; Hidi & Renninger, 2006; Silvia, 2008). But unlike surprise, interest involves an additional appraisal of **coping potential**. In appraisal theories, coping potential refers to people's evaluations of their ability to manage what is happening (Lazarus, 1991). When coping potential is high, people feel capable of handling the challenge at hand. For interest, this challenge is mental: Something odd and unexpected happened, and people can either feel able to understand it or not. When people encounter something that they appraise as both novel (high novelty and complexity) and comprehensible (high coping potential), they will find it interesting (Silvia, 2005).

The primary effect of interest is exploration: People will explore and think about the new and intriguing thing, be it an interesting object, person, or idea. By stimulating people to reflect and learn, interest builds knowledge and, in the long run, deep expertise. Consider, for example, the sometimes scary amount of knowledge people have about their hobbies. People who find cars, video games, high fashion, and soccer intrinsically interesting know an amazing amount about their passions—it would be hard to learn so much so quickly if people found it boring.

A huge amount of research shows that interest promotes learning that is faster, deeper, better, and more enjoyable (Hidi, 2001; Silvia, 2006). When people find material more interesting, they engage with it more deeply and learn it more thoroughly. This is true for simple kinds of learning—sentences and paragraphs are easier to remember when they are interesting (Sadoski, 2001; Schiefele, 1999)—and for broader academic success—people get better grades and feel more intellectually engaged in classes they find interesting (Krapp, 1999, 2002; Schiefele, Krapp, & Winteler, 1992).

Individual differences in interest are captured by **trait curiosity** (Kashdan, 2004; Kashdan et al., 2009). People low in curiosity prefer activities and ideas that are tried and true

and familiar; people high in curiosity, in contrast, prefer things that are offbeat and new. Trait curiosity is a facet of **openness to experience**, a broader trait that is one of the five major factors of personality (McCrae, 1996; McCrae & Sutin, 2009). Not surprisingly, being high in openness to experience involves exploring new things and finding quirky things appealing. Research shows that curious, open people ask more questions in class, own and read more books, eat a wider range of food, and—not surprisingly, given their lifetime of engaging with new things—are a bit higher in intelligence (DeYoung, 2011; Kashdan & Silvia, 2009; Peters, 1978; Raine, Reynolds, Venables, & Mednick, 2002).

Confusion

Sometimes the world is weird. Interest is a wonderful resource when people encounter new and unfamiliar things, but those things aren't always comprehensible. Confusion happens when people are learning something that is both unfamiliar and hard to understand. In the appraisal space shown in Figure 1, confusion comes from appraising an event as high in novelty, complexity, and unfamiliarity as well as appraising it as hard to comprehend (Silvia, 2010, 2012).



Has anyone ever told you to “look up that answer for yourself?” The effort of working through your own confusion helps you learn the material better than simply being given the answer. [Image: CollegeDegrees360, <https://goo.gl/1Edneb>, CC BY-SA 2.0, <https://goo.gl/rxiUsF>]

Confusion, like interest, promotes thinking and learning. This isn't an obvious idea—our intuitions would suggest that confusion makes people frustrated and thus more likely to tune out and quit. But as odd as it sounds, making students confused can help them learn better. In an approach to learning known as **impasse-driven learning** (VanLehn, Siler, Murray, Yamauchi, & Baggett, 2003), making students confused motivates them to think through a problem instead of

passively sitting and listening to what a teacher is saying. By actively thinking through the problem, students are learning actively and thus learning the material more deeply. In one experiment, for example, students learned about scientific research methods from two virtual reality tutors (D'Mello, Lehman, Pekrun, & Graesser, in press). The tutors sometimes contradicted each other, however, which made the students confused. Measures of simple learning (memory for basic concepts) and deep learning (being able to transfer an idea to a new area) showed that students who had to work through confusion learned more deeply—they were better at correctly applying what they learned to new problems.

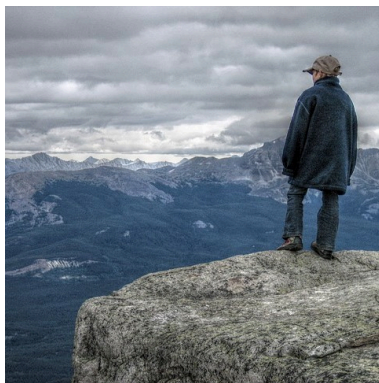
In a study of **facial expressions**, Rozin and Cohen (2003) demonstrated what all college teachers know: It's easy to spot confusion on someone's face. When people are confused, they usually furrow, scrunch, or lower their eyebrows and purse or bite their lips (Craig, D'Mello, Witherspoon, & Graesser, 2008);

Durso, Geldbach, & Corballis, 2012). In a clever application of these findings, researchers have developed artificial intelligence (AI) teaching and tutoring systems that can detect expressions of confusion (**Craig et al., 2008**). When the AI system detects confusion, it can ask questions and give hints that help the student work through the problem.

Not much is known about individual differences related to confusion, but differences in how much people know are important. In one research study, people viewed short film clips from movies submitted to a local film festival (**Silvia & Berg, 2011**). Some of the people were film experts, such as professors and graduate students in media studies and film theory; others were novices, such as the rest of us who simply watch movies for fun. The experts found the clips much more interesting and much less confusing than the novices did. A similar study discovered that experts in the arts found experimental visual art more interesting and less confusing than novices did (**Silvia, 2013**).

Awe

Awe—a state of fascination and wonder—is the deepest and probably least common of the knowledge emotions. When people are asked to describe profound experiences, such as the experience of beauty or spiritual transformation, awe is usually mentioned (Cohen, Gruber, & Keltner, 2010). People are likely to report experiencing awe when they are alone, engaged with art and music, or in nature (Shiota, Keltner, & Mossman, 2007).



Feeling awe often involves a sense of “feeling small,” like when you look up at the night sky or meet someone you really admire and respect. [Image: Kevin Dooley, <https://goo.gl/FECInE>, CC BY 2.0, <https://goo.gl/BRvSA7>]

Awe comes from two appraisals (Keltner & Haidt, 2003). First, people appraise something as vast, as beyond the normal scope of their experience. Thus, like the other knowledge emotions, awe involves appraising an event as inconsistent with one's existing knowledge, but the degree of inconsistency is huge, usually when people have never encountered something like the event before (Bonner & Friedman, 2011). Second, people engage in **accommodation**, which is changing their beliefs—about themselves, other people, or the world in general—to fit in the new experience. When something is massive (in size, scope, sound, creativity, or anything else) and when people change their beliefs to accommodate it, they'll experience awe.

A mild, everyday form of awe is **chills**, sometimes known as shivers or thrills. Chills involve getting goosebumps on the skin, especially the scalp, neck, back, and arms, usually as a wave

that starts at the head and moves downward. Chills are part of strong awe experiences, but people often experience them in response to everyday events, such as compelling music and movies (**Maruskin, Thrash, & Elliot, 2012; Nusbaum & Silvia, 2011**). Music that evokes chills, for example, tends to be loud, have a wide frequency range (such as both low and high frequencies), and major dynamic shifts, such as a shift from quiet to loud or a shift from few to many instruments (**Huron & Margulis, 2010**).

Like the other knowledge emotions, awe motivates people to engage with something outside the ordinary. Awe is thus a powerful educational tool. In science education, it is common to motivate learning by inspiring wonder. One example comes from a line of research on astronomy education, which seeks to educate the public about astronomy by using awe-inspiring images of deep space (**Arcand, Watzke, Smith, & Smith, 2010**). When people see beautiful and striking color images of supernovas, black holes, and planetary nebulas, they usually report feelings of awe and wonder. These feelings then motivate them to learn about what they are seeing and their scientific importance (**Smith et al., 2011**).

Regarding individual differences, some people experience awe much more often than others. One study that developed a brief scale to measure awe—the items included statements such as “I often feel awe” and “I feel wonder almost every day”—found that people who often experience awe are much higher in openness to experience (a trait associated with openness to new things and a wide emotional range) and in extraversion (a trait associated with positive emotionality) (**Shiota, Keltner, & John, 2006**). Similar findings appear for when people are asked how often they experience awe in response to the arts (**Nusbaum & Silvia, in press**). For example, people who say that they often “feel a sense of awe and wonder” when listening to music are much higher in openness to experience (**Silvia & Nusbaum, 2011**).

Implications of the Knowledge Emotions



knowledge emotions help us form relationships and solve important problems. [Image: CERDEC, <https://goo.gl/KQL8M8>, CC BY 2.0, <https://goo.gl/BRvSA7>]

Learning about the knowledge emotions expands our ideas about what emotions are and what they do. Emotions clearly play important roles in everyday challenges such as responding to threats and building relationships. But emotions also aid in other, more intellectual challenges for humans. Compared with other animals, we are born with little knowledge but have the potential for

enormous intelligence. Emotions such as surprise, interest, confusion, and awe first signal that something awry has happened that deserves our attention. They then motivate us to engage with the new things that strain our understanding of the world and how it works. Emotions surely aid fighting and fleeing, but for most of the hours of most of our days, they mostly aid in learning, exploring, and reflecting.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage

you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Accommodation

Changing one's beliefs about the world and how it works in light of new experience.

Appraisal structure

The set of appraisals that bring about an emotion.

Appraisal theories

Evaluations that relate what is happening in the environment to people's values, goals, and beliefs. Appraisal theories of emotion contend that emotions are caused by patterns of appraisals, such as whether an event furthers or hinders a goal and whether an event can be coped with.

Awe

An emotion associated with profound, moving experiences. Awe comes about when people encounter an event that is vast (far from normal experience) but that can be accommodated in existing knowledge.

Chills

A feeling of goosebumps, usually on the arms, scalp, and neck, that is often experienced during moments of awe.

Confusion

An emotion associated with conflicting and contrary information, such as when people appraise an event as unfamiliar and as hard to understand. Confusion motivates people to work through the perplexing information and thus fosters deeper learning.

Coping potential

People's beliefs about their ability to handle challenges.

Facial expressions

Part of the expressive component of emotions, facial expressions of emotion communicate inner feelings to others.

Functionalist theories of emotion

Theories of emotion that emphasize the adaptive role of an emotion in handling common problems throughout evolutionary history.

Impasse-driven learning

An approach to instruction that motivates active learning by having learners work through perplexing barriers.

Interest

An emotion associated with curiosity and intrigue, interest motivates engaging with new things and learning more about them. It is one of the earliest emotions to develop and a resource for intrinsically motivated learning across the life span.

Intrinsically motivated learning

Learning that is “for its own sake”—such as learning motivated by curiosity and wonder—instead of learning to gain rewards or social approval.

Knowledge emotions

A family of emotions associated with learning, reflecting, and exploring. These emotions come about when unexpected and unfamiliar events happen in the environment. Broadly speaking, they motivate people to explore unfamiliar things, which builds knowledge and expertise over the long run.

Openness to experience

One of the five major factors of personality, this trait is associated with higher curiosity, creativity, emotional

breadth, and open-mindedness. People high in openness to experience are more likely to experience interest and awe.

Surprise

An emotion rooted in expectancy violation that orients people toward the unexpected event.

Trait curiosity

Stable individual-differences in how easily and how often people become curious.

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12. Conditioning and Learning

Original chapter by Mark E. Bouton adapted by the Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

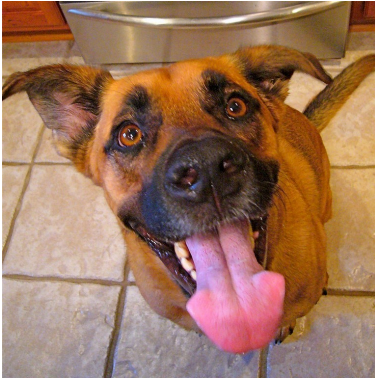
Basic principles of learning are always operating and always influencing human behavior. This module discusses the two most fundamental forms of learning — classical (Pavlovian) and instrumental (operant) conditioning. Through them, we respectively learn to associate 1) stimuli in the environment, or 2) our own behaviors, with significant events, such as rewards and punishments. The two types of learning have been intensively studied because they have powerful effects on behavior, and because they provide methods that allow scientists to analyze learning processes rigorously. This module describes some of the most important things you need to know about classical and instrumental conditioning, and it illustrates some of the many ways they help us understand normal and disordered behavior in humans. The module concludes by introducing the concept of observational learning, which is a form of learning that is largely distinct from classical and operant conditioning.

Learning Objectives

- Distinguish between classical (Pavlovian) conditioning and instrumental (operant) conditioning.
- Understand some important facts about each that tell us how they work.
- Understand how they work separately and together to influence human behavior in the world outside the laboratory.
- Students will be able to list the four aspects of observational learning according to Social Learning Theory.

Two Types of Conditioning

Although Ivan Pavlov won a Nobel Prize for studying digestion, he is much more famous for something else: working with a dog, a bell, and a bowl of saliva. Many people are familiar with the classic study of “Pavlov’s dog,” but rarely do they understand the significance of its discovery. In fact, Pavlov’s work helps explain why some people get anxious just looking at a crowded bus, why the sound of a morning alarm is so hated, and even why we swear off certain foods we’ve only tried once. Classical (or Pavlovian) conditioning is one of the fundamental ways we learn about the world around us. But it is far more than just a theory of learning; it is also arguably a theory of identity. For, once you understand classical conditioning, you’ll recognize that your favorite music, clothes, even political candidate, might all be a result of the same process that makes a dog drool at the sound of bell.



The Pavlov in All of Us: Does your dog learn to beg for food because you reinforce her by feeding her from the table? [Image: David Mease, <https://goo.gl/R9cQV7>, CC BY-NC 2.0, <https://goo.gl/Fllc2e>]

Around the turn of the 20th century, scientists who were interested in understanding the behavior of animals and humans began to appreciate the importance of two very basic forms of learning. One, which was first studied by the Russian physiologist Ivan Pavlov, is known as **classical**, or **Pavlovian conditioning**. In his famous experiment, Pavlov rang a bell and then gave a dog some food. After repeating this pairing multiple times, the dog

eventually treated the bell as a signal for food, and began salivating in anticipation of the treat. This kind of result has been reproduced in the lab using a wide range of signals (e.g., tones, light, tastes, settings) paired with many different events besides food (e.g., drugs, shocks, illness; see below).

We now believe that this same learning process is engaged, for example, when humans associate a drug they've taken with the environment in which they've taken it; when they associate a stimulus (e.g., a symbol for vacation, like a big beach towel) with an emotional event (like a burst of happiness); and when they associate the flavor of a food with getting food poisoning. Although classical conditioning may seem "old" or "too simple" a theory, it is still widely studied today for at least two reasons: First, it is a straightforward test of associative learning that can be used to study other, more complex behaviors. Second, because classical conditioning is always occurring in our lives, its effects on behavior have important implications for understanding normal and disordered behavior in humans.

In a general way, classical conditioning occurs whenever neutral stimuli are associated with psychologically significant events. With food poisoning, for example, although having fish for dinner may not normally be something to be concerned about (i.e., a “neutral stimuli”), if it causes you to get sick, you will now likely associate that neutral stimuli (the fish) with the psychologically significant event of getting sick. These paired events are often described using terms that can be applied to any situation.

The dog food in Pavlov’s experiment is called the **unconditioned stimulus (US)** because it elicits an **unconditioned response (UR)**. That is, without any kind of “training” or “teaching,” the stimulus produces a natural or instinctual reaction. In Pavlov’s case, the food (US) automatically makes the dog drool (UR). Other examples of unconditioned stimuli include loud noises (US) that startle us (UR), or a hot shower (US) that produces pleasure (UR). On the other hand, a conditioned stimulus produces a conditioned response. A **conditioned stimulus (CS)** is a signal that has no importance to the organism until it is paired with something that does have importance. For example, in Pavlov’s experiment, the bell is the conditioned stimulus. Before the dog has learned to associate the bell (CS) with the presence of food (US), hearing the bell means nothing to the dog. However, after multiple pairings of the bell with the presentation of food, the dog starts to drool at the sound of the bell. This drooling in response to the bell is the **conditioned response (CR)**. Although it can be confusing, the conditioned response is almost always the same as the unconditioned response. However, it is called the conditioned response because it is conditional on (or, depends on) being paired with the conditioned stimulus (e.g., the bell). To help make this clearer, consider becoming really hungry when you see the logo for a fast food restaurant. There’s a good chance you’ll start salivating. Although it is the actual eating of the food (US) that

normally produces the salivation (UR), simply seeing the restaurant's logo (CS) can trigger the same reaction (CR).

Another example you are probably very familiar with involves your alarm clock. If you're like most people, waking up early usually makes you unhappy. In this case, waking up early (US) produces a natural sensation of grumpiness (UR). Rather than waking up early on your own, though, you likely have an alarm clock that plays a tone to wake you. Before setting your alarm to that particular tone, let's imagine you had neutral feelings about it (i.e., the tone had no prior meaning for you). However, now that you use it to wake up every morning, you psychologically "pair" that tone (CS) with your feelings of grumpiness in the morning (UR). After enough pairings, this tone (CS) will automatically produce your natural response of grumpiness (CR). Thus, this linkage between the unconditioned stimulus (US; waking up early) and the conditioned stimulus (CS; the tone) is so strong that the unconditioned response (UR; being grumpy) will become a conditioned response (CR; e.g., hearing the tone at any point in the day—whether waking up or walking down the street—will make you grumpy). Modern studies of classical conditioning use a very wide range of CSs and USs and measure a wide range of conditioned responses.

Although classical conditioning is a powerful explanation for how we learn many different things, there is a second form of conditioning that also helps explain how we learn. First studied by Edward Thorndike, and later extended by B. F. Skinner, this second type of conditioning is known as **instrumental** or **operant conditioning**. Operant conditioning occurs when a *behavior* (as opposed to a stimulus) is associated with the occurrence of a significant event. In the best-



Receiving a reward can condition you toward certain behaviors. For example, when you were a child, your mother may have offered you this deal: “Don’t make a fuss when we’re in the supermarket and you’ll get a treat on the way out.”
[Image: Oliver Hammond, <https://goo.gl/xFKiZL>, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

known example, a rat in a laboratory learns to press a lever in a cage (called a “Skinner box”) to receive food. Because the rat has no “natural” association between pressing a lever and getting food, the rat has to learn this connection. At first, the rat may simply explore its cage, climbing on top of things, burrowing under things, in search of food. Eventually while poking around its cage, the rat accidentally presses the lever, and a food pellet drops in. This voluntary behavior is called an **operant** behavior, because it “operates” on the environment (i.e., it is an action that the animal itself makes).

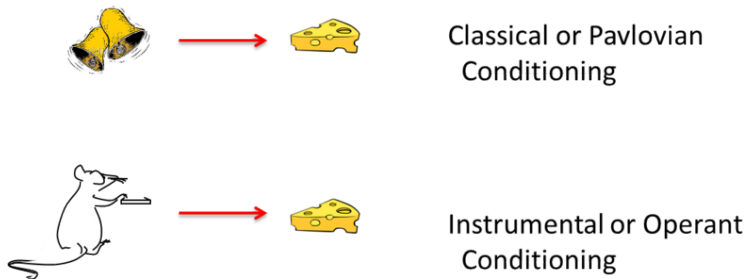
Now, once the rat recognizes that it receives a piece of food every time it presses the lever, the behavior of lever-pressing becomes reinforced. That is, the food pellets serve as **reinforcers** because they strengthen the rat’s desire to engage with the environment in this particular manner. In a parallel example, imagine that you’re playing a street-racing video

game. As you drive through one city course multiple times, you try a number of different streets to get to the finish line. On one of these trials, you discover a shortcut that dramatically improves your overall time. You have learned this new path through operant conditioning. That is, by engaging with your environment (operant responses), you performed a sequence of behaviors that that was positively reinforced (i.e., you found the shortest distance to the finish line). And now that you've learned how to drive this course, you will perform that same sequence of driving behaviors (just as the rat presses on the lever) to receive your reward of a faster finish.

Operant conditioning research studies how the effects of a behavior influence the probability that it will occur again. For example, the effects of the rat's lever-pressing behavior (i.e., receiving a food pellet) influences the probability that it will keep pressing the lever. For, according to Thorndike's **law of effect**, when a behavior has a positive (satisfying) effect or consequence, it is likely to be repeated in the future. However, when a behavior has a negative (painful/annoying) consequence, it is less likely to be repeated in the future. Effects that increase behaviors are referred to as reinforcers, and effects that decrease them are referred to as **punishers**.

An everyday example that helps to illustrate operant conditioning is striving for a good grade in class—which could be considered a reward for students (i.e., it produces a positive emotional response). In order to get that reward (similar to the rat learning to press the lever), the student needs to modify their behavior. For example, the student may learn that speaking up in class gets him/her participation points (a reinforcer), so the student speaks up repeatedly. However, the student also learns that s/he shouldn't speak up about just anything; talking about topics unrelated to school actually costs points. Therefore, through the student's freely chosen behaviors, s/he learns which behaviors are reinforced and which are punished. An important distinction of operant

conditioning is that it provides a method for studying how consequences influence “voluntary” behavior. The rat’s decision to press the lever is voluntary, in the sense that the rat is free to make and repeat that response whenever it wants. Classical conditioning, on the other hand, is just the opposite—depending instead on “involuntary” behavior (e.g., the dog doesn’t choose to drool; it just does). So, whereas the rat must actively participate and perform some kind of behavior to attain its reward, the dog in Pavlov’s experiment is a passive participant. One of the lessons of operant conditioning research, then, is that voluntary behavior is strongly influenced by its consequences.



[Image courtesy of Bernard W. Balleine]

The illustration above summarizes the basic elements of classical and instrumental conditioning. The two types of learning differ in many ways. However, modern thinkers often emphasize the fact that they differ—as illustrated here—in *what* is learned. In classical conditioning, the animal behaves as if it has learned to associate a *stimulus* with a significant event. In operant conditioning, the animal behaves as if it has learned to associate a *behavior* with a significant event. Another difference is that the response in the classical situation (e.g., salivation) is *elicited* by a stimulus that comes before it, whereas the response in the operant case is not elicited by

any particular stimulus. Instead, operant responses are said to be *emitted*. The word “emitted” further conveys the idea that operant behaviors are essentially voluntary in nature.

Understanding classical and operant conditioning provides psychologists with many tools for understanding learning and behavior in the world outside the lab. This is in part because the two types of learning occur continuously throughout our lives. It has been said that “much like the laws of gravity, the laws of learning are always in effect” (**Spreat & Spreat, 1982**).

Useful Things to Know about Classical Conditioning

Classical Conditioning Has Many Effects on Behavior

A classical CS (e.g., the bell) does not merely elicit a simple, unitary reflex. Pavlov emphasized salivation because that was the only response he measured. But his bell almost certainly elicited a whole *system* of responses that functioned to get the organism ready for the upcoming US (food) (see **Timberlake, 2001**). For example, in addition to salivation, CSs (such as the bell) that signal that food is near also elicit the secretion of gastric acid, pancreatic enzymes, and insulin (which gets blood glucose into cells). All of these responses prepare the body for digestion. Additionally, the CS elicits approach behavior and a state of excitement. And presenting a CS for food can also cause animals whose stomachs are full to eat more food if it is available. In fact, food CSs are so prevalent in modern society, humans are likewise inclined to eat or feel hungry in response to cues associated with food, such as the sound of a bag of

potato chips opening, the sight of a well-known logo (e.g., Coca-Cola), or the feel of the couch in front of the television.

Classical conditioning is also involved in other aspects of eating. Flavors associated with certain nutrients (such as sugar or fat) can become preferred without arousing any awareness of the pairing. For example, protein is a US that your body automatically craves more of once you start to consume it (UR): since proteins are highly concentrated in meat, the flavor of meat becomes a CS (or cue, that proteins are on the way), which perpetuates the cycle of craving for yet more meat (this automatic bodily reaction now a CR).

In a similar way, flavors associated with stomach pain or illness become avoided and *disliked*. For example, a person who gets sick after drinking too much tequila may acquire a profound dislike of the taste and odor of tequila—a phenomenon called **taste aversion conditioning**. The fact that flavors are often associated with so many consequences of eating is important for animals (including rats and humans) that are frequently exposed to new foods. And it is clinically relevant. For example, drugs used in chemotherapy often make cancer patients sick. As a consequence, patients often acquire aversions to foods eaten just before treatment, or even aversions to such things as the waiting room of the chemotherapy clinic itself (see **Bernstein, 1991; Scalera & Bavieri, 2009**).

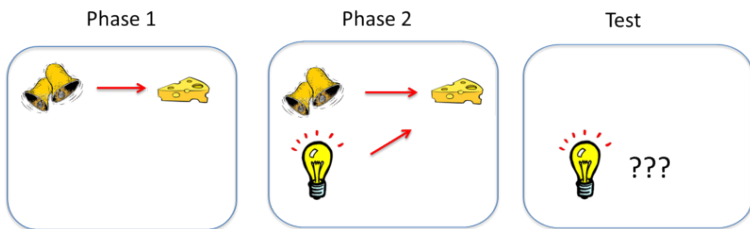
Classical conditioning occurs with a variety of significant events. If an experimenter sounds a tone just before applying a mild shock to a rat's feet, the tone will elicit fear or anxiety after one or two pairings. Similar **fear conditioning** plays a role in creating many anxiety disorders in humans, such as phobias and panic disorders, where people associate cues (such as closed spaces, or a shopping mall) with panic or other emotional trauma (see **Mineka & Zinbarg, 2006**). Here, rather than a physical response (like drooling), the CS triggers an emotion.

Another interesting effect of classical conditioning can occur when we ingest drugs. That is, when a drug is taken, it can be associated with the cues that are present at the same time (e.g., rooms, odors, drug paraphernalia). In this regard, if someone associates a particular smell with the sensation induced by the drug, whenever that person smells the same odor afterward, it may cue responses (physical and/or emotional) related to taking the drug itself. But drug cues have an even more interesting property: They elicit responses that often “compensate” for the upcoming effect of the drug (see **Siegel, 1989**). For example, morphine itself suppresses pain; however, if someone is used to taking morphine, a cue that signals the “drug is coming soon” can actually make the person more sensitive to pain. Because the person knows a pain suppressant will soon be administered, the body becomes more sensitive, anticipating that “the drug will soon take care of it.” Remarkably, such **conditioned compensatory responses** in turn decrease the impact of the drug on the body—because the body has become more sensitive to pain.

This conditioned compensatory response has many implications. For instance, a drug user will be most “tolerant” to the drug in the presence of cues that have been associated with it (because such cues elicit compensatory responses). As a result, overdose is usually not due to an increase in dosage, but to taking the drug in a new place without the familiar cues—which would have otherwise allowed the user to tolerate the drug (see **Siegel, Hinson, Krank, & McCully, 1982**). Conditioned compensatory responses (which include heightened pain sensitivity and decreased body temperature, among others) might also cause discomfort, thus motivating the drug user to continue usage of the drug to reduce them. This is one of several ways classical conditioning might be a factor in drug addiction and dependence.

A final effect of classical cues is that they motivate ongoing operant behavior (see **Balleine, 2005**). For example, if a rat has

learned via operant conditioning that pressing a lever will give it a drug, in the presence of cues that signal the “drug is coming soon” (like the sound of the lever squeaking), the rat will work harder to press the lever than if those cues weren’t present (i.e., there is no squeaking lever sound). Similarly, in the presence of food-associated cues (e.g., smells), a rat (or an overeater) will work harder for food. And finally, even in the presence of negative cues (like something that signals fear), a rat, a human, or any other organism will work harder to avoid those situations that might lead to trauma. Classical CSs thus have many effects that can contribute to significant behavioral phenomena.



[Image courtesy of Bernard W. Balleine]

The Learning Process

As mentioned earlier, classical conditioning provides a method for studying basic learning processes. Somewhat counterintuitively, though, studies show that pairing a CS and a US together is not sufficient for an association to be learned between them. Consider an effect called **blocking** (see **Kamin, 1969**). In this effect, an animal first learns to associate one CS—call it stimulus A—with a US. In the illustration above, the sound of a bell (stimulus A) is paired with the presentation of food. Once this association is learned, in a second phase, a second stimulus—stimulus B—is presented alongside stimulus

A, such that the two stimuli are paired with the US together. In the illustration, a light is added and turned on at the same time the bell is rung. However, because the animal has already learned the association between stimulus A (the bell) and the food, the animal doesn't learn an association between stimulus B (the light) and the food. That is, the conditioned response only occurs during the presentation of stimulus A, because the earlier conditioning of A "blocks" the conditioning of B when B is added to A. The reason? Stimulus A already predicts the US, so the US is not surprising when it occurs with Stimulus B.

Learning depends on such a surprise, or a discrepancy between what occurs on a conditioning trial and what is already predicted by cues that are present on the trial. To learn something through classical conditioning, there must first be some **prediction error**, or the chance that a conditioned stimulus won't lead to the expected outcome. With the example of the bell and the light, because the bell always leads to the reward of food, there's no "prediction error" that the addition of the light helps to correct. However, if the researcher suddenly requires that the bell and the light both occur in order to receive the food, the bell alone will produce a prediction error that the animal has to learn.

Blocking and other related effects indicate that the learning process tends to take in the most valid predictors of significant events and ignore the less useful ones. This is common in the real world. For example, imagine that your supermarket puts big star-shaped stickers on products that are on sale. Quickly, you learn that items with the big star-shaped stickers are cheaper. However, imagine you go into a similar supermarket that not only uses these stickers, but also uses bright orange price tags to denote a discount. Because of blocking (i.e., you already know that the star-shaped stickers indicate a discount), you don't have to learn the color system, too. The star-shaped stickers tell you everything you need to know (i.e. there's no

prediction error for the discount), and thus the color system is irrelevant.

Classical conditioning is strongest if the CS and US are intense or salient. It is also best if the CS and US are relatively new and the organism hasn't been frequently exposed to them before. And it is especially strong if the organism's biology has prepared it to associate a particular CS and US. For example, rats and humans are naturally inclined to associate an illness with a flavor, rather than with a light or tone. Because foods are most commonly experienced by taste, if there is a particular food that makes us ill, associating the flavor (rather than the appearance—which may be similar to other foods) with the illness will more greatly ensure we avoid that food in the future, and thus avoid getting sick. This sorting tendency, which is set up by evolution, is called **preparedness**.

There are many factors that affect the strength of classical conditioning, and these have been the subject of much research and theory (see **Rescorla & Wagner, 1972; Pearce & Bouton, 2001**). Behavioral neuroscientists have also used classical conditioning to investigate many of the basic brain processes that are involved in learning (see **Fanselow & Poulos, 2005; Thompson & Steinmetz, 2009**).

Erasing Classical Learning

After conditioning, the response to the CS can be eliminated if the CS is presented repeatedly without the US. This effect is called **extinction**, and the response is said to become “extinguished.” For example, if Pavlov kept ringing the bell but never gave the dog any food afterward, eventually the dog's CR (drooling) would no longer happen when it heard the CS (the bell), because the bell would no longer be a predictor of food. Extinction is important for many reasons. For one thing, it is the basis for many therapies that clinical psychologists

use to eliminate maladaptive and unwanted behaviors. Take the example of a person who has a debilitating fear of spiders: one approach might include systematic exposure to spiders. Whereas, initially the person has a CR (e.g., extreme fear) every time s/he sees the CS (e.g., the spider), after repeatedly being shown pictures of spiders in neutral conditions, pretty soon the CS no longer predicts the CR (i.e., the person doesn't have the fear reaction when seeing spiders, having learned that spiders no longer serve as a "cue" for that fear). Here, repeated exposure to spiders without an aversive consequence causes extinction.

Psychologists must accept one important fact about extinction, however: it does not necessarily destroy the original learning (see **Bouton, 2004**). For example, imagine you strongly associate the smell of chalkboards with the agony of middle school detention. Now imagine that, after years of encountering chalkboards, the smell of them no longer recalls the agony of detention (an example of extinction). However, one day, after entering a new building for the first time, you suddenly catch a whiff of a chalkboard and WHAM!, the agony of detention returns. This is called **spontaneous recovery**: following a lapse in exposure to the CS after extinction has occurred, sometimes re-exposure to the CS (e.g., the smell of chalkboards) can evoke the CR again (e.g., the agony of detention).

Another related phenomenon is the **renewal effect**: After extinction, if the CS is tested in a new **context**, such as a different room or location, the CR can also return. In the chalkboard example, the action of entering a new building—where you don't expect to smell chalkboards—suddenly renews the sensations associated with detention. These effects have been interpreted to suggest that extinction *inhibits* rather than erases the learned behavior, and this inhibition is mainly expressed in the context in which it is learned (see "context" in the Key Vocabulary section below).

This does not mean that extinction is a bad treatment for behavior disorders. Instead, clinicians can increase its effectiveness by using basic research on learning to help defeat these relapse effects (see **Craske et al., 2008**). For example, conducting extinction therapies in contexts where patients might be most vulnerable to relapsing (e.g., at work), might be a good strategy for enhancing the therapy's success.

Useful Things to Know about Instrumental Conditioning

Most of the things that affect the strength of classical conditioning also affect the strength of instrumental learning—whereby we learn to associate our actions with their outcomes. As noted earlier, the “bigger” the reinforcer (or punisher), the stronger the learning. And, if an instrumental behavior is no longer reinforced, it will also be extinguished. Most of the rules of associative learning that apply to classical conditioning also apply to instrumental learning, but other facts about instrumental learning are also worth knowing.

Instrumental Responses Come Under Stimulus Control

As you know, the classic operant response in the laboratory is lever-pressing in rats, reinforced by food. However, things can be arranged so that lever-pressing only produces pellets when a particular stimulus is present. For example, lever-pressing can be reinforced only when a light in the Skinner box is turned on; when the light is off, no food is released from lever-pressing. The rat soon learns to discriminate between the light-on and light-off conditions, and presses the lever only in the presence

of the light (responses in light-off are extinguished). In everyday life, think about waiting in the turn lane at a traffic light. Although you know that green means go, only when you have the green *arrow* do you turn. In this regard, the operant behavior is now said to be under **stimulus control**. And, as is the case with the traffic light, in the real world, stimulus control is probably the rule.

The stimulus controlling the operant response is called a **discriminative stimulus**. It can be associated directly with the response, or the reinforcer (see below). However, it usually does not elicit the response the way a classical CS does. Instead, it is said to “set the occasion for” the operant response. For example, a canvas put in front of an artist does not elicit painting behavior or compel her to paint. It allows, or sets the occasion for, painting to occur.

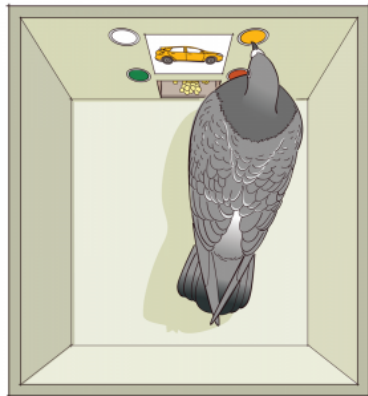
Stimulus-control techniques are widely used in the laboratory to study perception and other psychological processes in animals. For example, the rat would not be able to respond appropriately to light-on and light-off conditions if it could not see the light. Following this logic, experiments using stimulus-control methods have tested how well animals see colors, hear ultrasounds, and detect magnetic fields. That is, researchers pair these discriminative stimuli with those they know the animals already understand (such as pressing the lever). In this way, the researchers can test if the animals can learn to press the lever only when an ultrasound is played, for example.

These methods can also be used to study “higher” cognitive processes. For example, pigeons can learn to peck at different buttons in a Skinner box when pictures of flowers, cars, chairs, or people are shown on a miniature TV screen (see **Wasserman, 1995**). Pecking button 1 (and no other) is reinforced in the presence of a flower image, button 2 in the presence of a chair image, and so on. Pigeons can learn the discrimination readily, and, under the right conditions, will even peck the correct

buttons associated with pictures of *new* flowers, cars, chairs, and people they have never seen before. The birds have learned to **categorize** the sets of stimuli. Stimulus-control methods can be used to study how such categorization is learned.

Operant Conditioning Involves Choice

Another thing to know about operant conditioning is that the response always requires choosing one behavior over others. The student who goes to the bar on Thursday night chooses to drink instead of staying at home and studying. The rat chooses to press the lever instead of sleeping or scratching its ear in the back of the box. The



alternative behaviors are each associated with their own reinforcers. And the tendency to perform a particular action depends on both the reinforcers earned for it and the reinforcers earned for its alternatives.

To investigate this idea, choice has been studied in the Skinner box by making two levers available for the rat (or two buttons available for the pigeon), each of which has its own reinforcement or payoff rate. A thorough study of choice in situations like this has led to a rule called the **quantitative law of effect** (see **Herrnstein, 1970**), which can be understood without going into quantitative detail: The law acknowledges the fact that the effects of reinforcing one behavior depend crucially on how much reinforcement is earned for the behavior's alternatives. For example, if a pigeon learns that pecking one light will reward two food pellets, whereas the

other light only rewards one, the pigeon will only peck the first light. However, what happens if the first light is more strenuous to reach than the second one? Will the cost of energy outweigh the bonus of food? Or will the extra food be worth the work? In general, a given reinforcer will be less reinforcing if there are many alternative reinforcers in the environment. For this reason, alcohol, sex, or drugs may be less powerful reinforcers if the person's environment is full of other sources of reinforcement, such as achievement at work or love from family members.

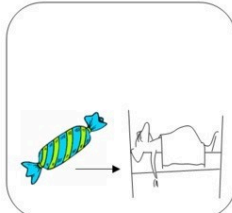
Cognition in Instrumental Learning

Modern research also indicates that reinforcers do more than merely strengthen or “stamp in” the behaviors they are a consequence of, as was Thorndike's original view. Instead, animals learn about the specific consequences of each behavior, and will perform a behavior depending on how much they currently want—or “value”—its consequence.

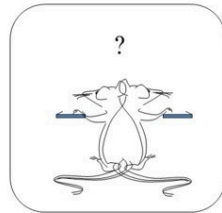
1. Instrumental Learning



2. Taste aversion learning



3. Test



[Image courtesy of Bernard W. Balleine]

This idea is best illustrated by a phenomenon called the **reinforcer devaluation effect** (see **Colwill & Rescorla, 1986**). A rat is first trained to perform two instrumental actions (e.g.,

pressing a lever on the left, and on the right), each paired with a different reinforcer (e.g., a sweet sucrose solution, and a food pellet). At the end of this training, the rat tends to press both levers, alternating between the sucrose solution and the food pellet. In a second phase, one of the reinforcers (e.g., the sucrose) is then separately paired with illness. This conditions a taste aversion to the sucrose. In a final test, the rat is returned to the Skinner box and allowed to press either lever freely. No reinforcers are presented during this test (i.e., no sucrose or food comes from pressing the levers), so behavior during testing can only result from the rat's memory of what it has learned earlier. Importantly here, the rat chooses *not* to perform the response that once produced the reinforcer that it now has an aversion to (e.g., it won't press the sucrose lever). This means that the rat has learned and remembered the reinforcer associated with each response, and can combine that knowledge with the knowledge that the reinforcer is now "bad." Reinforcers do not merely stamp in responses; the animal learns much more than that. The behavior is said to be "**goal-directed**" (see **Dickinson & Balleine, 1994**), because it is influenced by the current value of its associated goal (i.e., how much the rat wants/doesn't want the reinforcer).

Things can get more complicated, however, if the rat performs the instrumental actions frequently and repeatedly. That is, if the rat has spent many months learning the value of pressing each of the levers, the act of pressing them becomes automatic and routine. And here, this once goal-directed action (i.e., the rat pressing the lever for the goal of getting sucrose/food) can become a **habit**. Thus, if a rat spends many months performing the lever-pressing behavior (turning such behavior into a habit), even when sucrose is again paired with illness, the rat will continue to press that lever (see **Holland, 2004**). After all the practice, the instrumental response (pressing the lever) is no longer sensitive to reinforcer devaluation. The rat continues to respond automatically,

regardless of the fact that the sucrose from this lever makes it sick.

Habits are very common in human experience, and can be useful. You do not need to relearn each day how to make your coffee in the morning or how to brush your teeth. Instrumental behaviors can eventually become habitual, letting us get the job done while being free to think about other things.

Putting Classical and Instrumental Conditioning Together

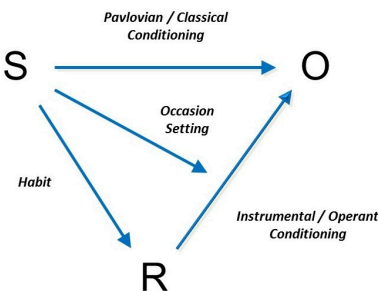
Classical and operant conditioning are usually studied separately. But outside of the laboratory they almost always occur at the same time. For example, a person who is reinforced for drinking alcohol or eating excessively learns these behaviors in the presence of certain stimuli—a pub, a set of friends, a restaurant, or possibly the couch in front of the TV. These stimuli are also available for association with the reinforcer. In this way, classical and operant conditioning are always intertwined.

The figure below summarizes this idea, and helps review what we have discussed in this module. Generally speaking, any reinforced or punished operant response (R) is paired with an outcome (O) in the presence of some stimulus or set of stimuli (S).

The figure illustrates the types of associations that can be learned in this very general scenario. For one thing, the organism will learn to associate the response *and* the outcome (R – O). This is instrumental conditioning. The learning process here is probably similar to classical conditioning, with all its emphasis on surprise and prediction error. And, as we discussed while considering the reinforcer devaluation effect, once R – O is learned, the organism will be ready to perform the

response if the outcome is desired or valued. The value of the reinforcer can also be influenced by other reinforcers earned for other behaviors in the situation. These factors are at the heart of instrumental learning.

Second, the organism can also learn to associate the stimulus with the reinforcing outcome (S – O). This is the classical conditioning component, and as we have seen, it can have many consequences on behavior. For one thing, the stimulus will come to evoke a system of responses that help the organism prepare for the reinforcer (not shown in the figure): The drinker may undergo changes in body temperature; the eater may salivate and have an increase in insulin secretion. In addition, the stimulus will evoke approach (if the outcome is positive) or retreat (if the outcome is negative). Presenting the stimulus will also prompt the instrumental response.



The third association in the diagram is the one between the stimulus and the response (S – R). As discussed earlier, after a lot of practice, the stimulus may begin to elicit the response directly. This is habit learning, whereby the response occurs

relatively automatically, without much mental processing of the relation between the action and the outcome and the outcome's current value.

The final link in the figure is between the stimulus and the response-outcome association [S – (R – O)]. More than just entering into a simple association with the R or the O, the stimulus can signal that the R – O relationship is now in effect. This is what we mean when we say that the stimulus can “set the occasion” for the operant response: It sets the occasion for the response-reinforcer relationship. Through this mechanism, the painter might begin to paint when given the right tools

and the opportunity enabled by the canvas. The canvas theoretically signals that the behavior of painting will now be reinforced by positive consequences.

The figure provides a framework that you can use to understand almost any learned behavior you observe in yourself, your family, or your friends. If you would like to understand it more deeply, consider taking a course on learning in the future, which will give you a fuller appreciation of how classical learning, instrumental learning, habit learning, and occasion setting actually work and interact.

Observational Learning

Not all forms of learning are accounted for entirely by classical and operant conditioning. Imagine a child walking up to a group of children playing a game on the playground. The game looks fun, but it is new and unfamiliar. Rather than joining the game immediately, the child opts to sit back and watch the other children play a round or two. Observing the others, the child takes note of the ways in which they behave while playing the game. By watching the behavior of the other kids, the child can figure out the rules of the game and even some strategies for doing well at the game. This is called **observational learning**.



Children observing a social model (an experienced chess player) to learn the rules and strategies of the game of chess. [Image: David R. Tribble, <https://goo.gl/nWsgxl>, CC BY-SA 3.0, <https://goo.gl/uhHOLA>]

Observational learning is a component of Albert Bandura's **Social Learning Theory** (Bandura, 1977), which posits that individuals can learn novel responses via observation of key others' behaviors. Observational learning does not necessarily require reinforcement, but instead hinges on the presence of others, referred to as **social models**. Social models are typically of higher status or authority compared to the observer, examples of

which include parents, teachers, and police officers. In the example above, the children who already know how to play the game could be thought of as being authorities—and are therefore social models—even though they are the same age as the observer. By observing how the social models behave, an individual is able to learn how to act in a certain situation. Other examples of observational learning might include a child learning to place her napkin in her lap by watching her parents at the dinner table, or a customer learning where to find the ketchup and mustard after observing other customers at a hot dog stand.

Bandura theorizes that the observational learning process consists of four parts. The first is *attention*—as, quite simply, one must pay attention to what s/he is observing in order to learn. The second part is *retention*: to learn one must be able to retain the behavior s/he is observing in memory. The third part of observational learning, *initiation*, acknowledges that the learner must be able to execute (or initiate) the learned behavior. Lastly, the observer must possess the *motivation* to

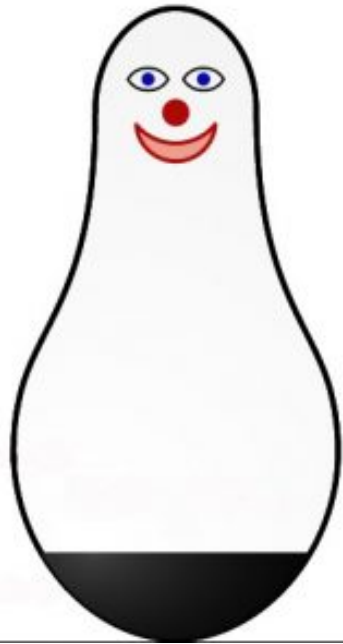
engage in observational learning. In our vignette, the child must want to learn how to play the game in order to properly engage in observational learning.

Researchers have conducted countless experiments designed to explore observational learning, the most famous of which is Albert Bandura's "Bobo doll experiment."

In this experiment (Bandura, Ross & Ross 1961), Bandura had children individually observe an adult social model interact with a clown doll ("Bobo"). For one group of children, the adult interacted aggressively with Bobo: punching it, kicking it, throwing it, and even hitting it in the face with a toy mallet. Another group of children watched the adult interact with other toys, displaying no aggression toward Bobo. In both instances the adult left and the children were allowed to interact with Bobo on their own. Bandura found that children exposed to the aggressive social model were significantly more likely to

behave aggressively toward Bobo, hitting and kicking him, compared to those exposed to the non-aggressive model. The researchers concluded that the children in the aggressive group used their observations of the adult social model's behavior to determine that aggressive behavior toward Bobo was acceptable.

While reinforcement was not required to elicit the children's



Bobo [Image: © Sémhur / Wikimedia Commons / CC-BY-SA-3.0 (or Free Art License), <https://goo.gl/uhHOLA>]

behavior in Bandura's first experiment, it is important to acknowledge that consequences do play a role within observational learning. A future adaptation of this study (**Bandura, Ross, & Ross, 1963**) demonstrated that children in the aggression group showed less aggressive behavior if they witnessed the adult model receive punishment for aggressing against Bobo. Bandura referred to this process as **vicarious reinforcement**, as the children did not experience the reinforcement or punishment directly, yet were still influenced by observing it.

Comparative Cognition at Queen's University

Queen's Psychology offers a course for those interested in learning more about the science of learning, and about similarities and differences of cognition across animal species (including humans!). If you are interested in learning more about this area, we encourage you to consider PSYC305: Comparative Cognition.

Conclusion

We have covered three primary explanations for how we learn to behave and interact with the world around us. Considering your own experiences, how well do these theories apply to you? Maybe when reflecting on your personal sense of fashion, you realize that you tend to select clothes others have complimented you on (operant conditioning). Or maybe, thinking back on a new restaurant you tried recently, you realize you chose it because its commercials play happy music (classical conditioning). Or maybe you are now always on time

with your assignments, because you saw how others were punished when they were late (observational learning). Regardless of the activity, behavior, or response, there's a good chance your "decision" to do it can be explained based on one of the theories presented in this module.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Blocking

In classical conditioning, the finding that no conditioning occurs to a stimulus if it is combined with a previously conditioned stimulus during conditioning trials. Suggests that information, surprise value, or prediction error is important in conditioning.

Categorize

To sort or arrange different items into classes or categories.

Classical conditioning

The procedure in which an initially neutral stimulus (the conditioned stimulus, or CS) is paired with an unconditioned stimulus (or US). The result is that the conditioned stimulus begins to elicit a conditioned response (CR). Classical conditioning is nowadays considered important as both a behavioral phenomenon and as a method to study simple associative learning. Same as Pavlovian conditioning.

Conditioned compensatory response

In classical conditioning, a conditioned response that opposes, rather than is the same as, the unconditioned response. It functions to reduce the strength of the unconditioned response. Often seen in conditioning when drugs are used as unconditioned stimuli.

Conditioned response (CR)

The response that is elicited by the conditioned stimulus after classical conditioning has taken place.

Conditioned stimulus (CS)

An initially neutral stimulus (like a bell, light, or tone) that elicits a conditioned response after it has been associated with an unconditioned stimulus.

Context

Stimuli that are in the background whenever learning occurs. For instance, the Skinner box or room in which learning takes place is the classic example of a context. However, "context" can also be provided by internal stimuli, such as the sensory effects of drugs (e.g., being under the influence of alcohol has stimulus properties that

provide a context) and mood states (e.g., being happy or sad). It can also be provided by a specific period in time—the passage of time is sometimes said to change the “temporal context.”

Discriminative stimulus

In operant conditioning, a stimulus that signals whether the response will be reinforced. It is said to “set the occasion” for the operant response.

Extinction

Decrease in the strength of a learned behavior that occurs when the conditioned stimulus is presented without the unconditioned stimulus (in classical conditioning) or when the behavior is no longer reinforced (in instrumental conditioning). The term describes both the procedure (the US or reinforcer is no longer presented) as well as the result of the procedure (the learned response declines). Behaviors that have been reduced in strength through extinction are said to be “extinguished.”

Fear conditioning

A type of classical or Pavlovian conditioning in which the conditioned stimulus (CS) is associated with an aversive unconditioned stimulus (US), such as a foot shock. As a consequence of learning, the CS comes to evoke fear. The phenomenon is thought to be involved in the development of anxiety disorders in humans.

Goal-directed behavior

Instrumental behavior that is influenced by the animal's knowledge of the association between the behavior and its consequence and the current value of the consequence. Sensitive to the reinforcer devaluation effect.

Habit

Instrumental behavior that occurs automatically in the presence of a stimulus and is no longer influenced by the animal's knowledge of the value of the reinforcer. Insensitive to the reinforcer devaluation effect.

Instrumental conditioning

Process in which animals learn about the relationship between their behaviors and their consequences. Also known as operant conditioning.

Law of effect

The idea that instrumental or operant responses are influenced by their effects. Responses that are followed by a pleasant state of affairs will be strengthened and those that are followed by discomfort will be weakened. Nowadays, the term refers to the idea that operant or instrumental behaviors are lawfully controlled by their consequences.

Observational learning

Learning by observing the behavior of others.

Operant

A behavior that is controlled by its consequences. The simplest example is the rat's lever-pressing, which is controlled by the presentation of the reinforcer.

Operant conditioning

See instrumental conditioning.

Pavlovian conditioning

See classical conditioning.

Prediction error

When the outcome of a conditioning trial is different from that which is predicted by the conditioned stimuli that are present on the trial (i.e., when the US is surprising).

Prediction error is necessary to create Pavlovian conditioning (and associative learning generally). As learning occurs over repeated conditioning trials, the conditioned stimulus increasingly predicts the unconditioned stimulus, and prediction error declines. Conditioning works to correct or reduce prediction error.

Preparedness

The idea that an organism's evolutionary history can make it easy to learn a particular association. Because of preparedness, you are more likely to associate the taste of tequila, and not the circumstances surrounding drinking it, with getting sick. Similarly, humans are more likely to associate images of spiders and snakes than flowers and mushrooms with aversive outcomes like shocks.

Punisher

A stimulus that decreases the strength of an operant behavior when it is made a consequence of the behavior.

Quantitative law of effect

A mathematical rule that states that the effectiveness of a reinforcer at strengthening an operant response depends on the amount of reinforcement earned for all alternative behaviors. A reinforcer is less effective if there is a lot of reinforcement in the environment for other behaviors.

Reinforcer

Any consequence of a behavior that strengthens the behavior or increases the likelihood that it will be performed it again.

Reinforcer devaluation effect

The finding that an animal will stop performing an instrumental response that once led to a reinforcer if the reinforcer is separately made aversive or undesirable.

Renewal effect

Recovery of an extinguished response that occurs when the context is changed after extinction. Especially strong when the change of context involves return to the context in which conditioning originally occurred. Can occur after extinction in either classical or instrumental conditioning.

Social Learning Theory

The theory that people can learn new responses and behaviors by observing the behavior of others.

Social models

Authorities that are the targets for observation and who model behaviors.

Spontaneous recovery

Recovery of an extinguished response that occurs with the passage of time after extinction. Can occur after extinction in either classical or instrumental conditioning.

Stimulus control

When an operant behavior is controlled by a stimulus that precedes it.

Taste aversion learning

The phenomenon in which a taste is paired with sickness, and this causes the organism to reject—and dislike—that taste in the future.

Unconditioned response (UR)

In classical conditioning, an innate response that is elicited by a stimulus before (or in the absence of) conditioning.

Unconditioned stimulus (US)

In classical conditioning, the stimulus that elicits the response before conditioning occurs.

Vicarious reinforcement

Learning that occurs by observing the reinforcement or punishment of another person.

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13. Factors Influencing Learning

Original chapter by Aaron Benjamin
adapted by the Queen's University
Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

Learning is a complex process that defies easy definition and description. This module reviews some of the philosophical issues involved with defining learning and describes in some detail the characteristics of learners and of encoding activities that seem to affect how well people can acquire new memories, knowledge, or skills. At the end, we consider a few basic principles that guide whether a particular attempt at learning will be successful or not.

Learning Objectives

- Consider what kinds of activities constitute learning.
- Name multiple forms of learning.
- List some individual differences that affect learning.
- Describe the effect of various encoding activities on

learning.

- Describe three general principles of learning.

Introduction

What do you do when studying for an exam? Do you read your class notes and textbook (hopefully not for the very first time)? Do you try to find a quiet place without distraction? Do you use flash cards to test your knowledge? The choices you make reveal your theory of learning, but there is no reason for you to limit yourself to your own intuitions. There is a vast and vibrant science of learning, in which researchers from psychology, education, and neuroscience study basic principles of learning and memory.



When you study for a test, you incorporate your past knowledge into learning this new knowledge. That is, depending on your previous experiences, you will “learn” the material in different ways. [Image: UBC Learning Commons, <https://goo.gl/eTOjvd>, CC BY 2.0, <https://goo.gl/BRvSA7>]

In fact, learning is a much broader domain than you might think. Consider: Is listening to music a form of learning? More often, it seems listening to music is a way of avoiding learning. But we know that your brain’s response to auditory information changes with your experience with that information, a form of learning called **auditory perceptual learning (Polley, Steinberg, & Merzenich, 2006)**. Each time we listen to a song, we hear it differently

because of our experience. When we exhibit changes in behavior without having intended to learn something, that is called **implicit learning (Seger, 1994)**, and when we exhibit

changes in our behavior that reveal the influence of past experience even though we are not attempting to use that experience, that is called **implicit memory** (Richardson-Klavehn & Bjork, 1988).

Other well-studied forms of learning include the types of learning that are general across species. We can't ask a slug to learn a poem or a lemur to learn to bat left-handed, but we can assess learning in other ways. For example, we can look for a change in our responses to things when we are repeatedly stimulated. If you live in a house with a grandfather clock, you know that what was once an annoying and intrusive sound is now probably barely audible to you. Similarly, poking an earthworm again and again is likely to lead to a reduction in its retraction from your touch. These phenomena are forms of **nonassociative learning**, in which single repeated exposure leads to a change in behavior (Pinsker, Kupfermann, Castelluci, & Kandel, 1970). When our response lessens with exposure, it is called **habituation**, and when it increases (like it might with a particularly annoying laugh), it is called **sensitization**. Animals can also learn about relationships between things, such as when an alley cat learns that the sound of janitors working in a restaurant precedes the dumping of delicious new garbage (an example of stimulus-stimulus learning called **classical conditioning**), or when a dog learns to roll over to get a treat (a form of stimulus-response learning called **operant conditioning**). These forms of learning will be covered in the module on Conditioning and Learning.

Here, we'll review some of the conditions that affect learning, with an eye toward the type of explicit learning we do when trying to learn something. Jenkins (1979) classified experiments on learning and memory into four groups of factors (renamed here): learners, encoding activities, materials, and retrieval. In this module, we'll focus on the first two

categories; the module on Memory will consider other factors more generally.

Learners

People bring numerous individual differences with them into memory experiments, and many of these variables affect learning. In the classroom, motivation matters (**Pintrich, 2003**), though experimental attempts to induce motivation with money yield only modest benefits (**Heyer & O'Kelly, 1949**). Learners are, however, quite able to allocate more effort to learning prioritized over unimportant materials (**Castel, Benjamin, Craik, & Watkins, 2002**).

In addition, the organization and planning skills that a learner exhibits matter a lot (**Garavalia & Gredler, 2002**), suggesting that the efficiency with which one organizes self-guided learning is an important component of learning. We will return to this topic soon.

One well-studied and important variable is **working memory** capacity. Working memory describes the form of memory we use to hold onto information temporarily. Working memory is used, for example, to keep track of where we are in the course of a complicated math problem, and what the relevant outcomes of prior steps in that problem are. Higher scores on working memory measures are predictive of better reasoning skills (Kyllonen & Christal, **1990**),



Research attests that we can hold between 5 and 9 individual pieces of information in our working memory at once. This is partly why in the 1950s Bell Labs developed a 7-digit phone number system.

[Image: Diamondmagna, <https://goo.gl/xUxfw>, CC BY-SA 3.0, <https://goo.gl/eLCn2O>]

reading comprehension (Daneman & Carpenter, **1980**), and even better control of attention (Kane, Conway, Hambrick, & Engle, **2008**).

Anxiety also affects the quality of learning. For example, people with math anxiety have a smaller capacity for remembering math-related information in working memory, such as the results of carrying a digit in arithmetic (**Ashcraft & Kirk, 2001**). Having students write about their specific anxiety seems to reduce the worry associated with tests and increases performance on math tests (**Ramirez & Beilock, 2011**).

One good place to end this discussion is to consider the role of expertise. Though there probably is a finite capacity on our ability to store information (**Landauer, 1986**), in practice, this concept is misleading. In fact, because the usual bottleneck to remembering something is our ability to *access* information, not our space to *store* it, having more knowledge or expertise actually enhances our ability to learn new information. A classic

example can be seen in comparing a chess master with a chess novice on their ability to learn and remember the positions of pieces on a chessboard (**Chase & Simon, 1973**). In that experiment, the master remembered the location of many more pieces than the novice, even after only a very short glance. Maybe chess masters are just smarter than the average chess beginner, and have better memory? No: The advantage the expert exhibited only was apparent when the pieces were arranged in a plausible format for an ongoing chess game; when the pieces were placed randomly, both groups did equivalently poorly. Expertise allowed the master to **chunk** (**Simon, 1974**) multiple pieces into a smaller number of pieces of information—but only when that information was structured in such a way so as to allow the application of that expertise.

Encoding Activities

What we do when we're learning is very important. We've all had the experience of reading something and suddenly coming to the realization that we don't remember a single thing, even the sentence that we just read. *How* we go about **encoding** information determines a lot about how much we remember.

You might think that the most important thing is to *try* to learn. Interestingly, this is not true, at least not completely. Trying to learn a list of words, as compared to just evaluating each word for its part of speech (i.e., noun, verb, adjective) does help you *recall* the words—that is, it helps you remember and write down more of the words later. But it actually impairs your ability to *recognize* the words—to judge on a later list which words are the ones that you studied (**Eagle & Leiter, 1964**). So this is a case in which **incidental learning**—that is, learning without the intention to learn—is better than **intentional learning**.

Such examples are not particularly rare and are not limited to recognition. Nairne, Pandeirada, and Thompson (2008) showed, for example, that survival processing—thinking about and rating each word in a list for its relevance in a survival scenario—led to much higher recall than intentional learning (and also higher, in fact, than other encoding activities that are also known to lead to high levels of recall). Clearly, merely intending to learn something is not enough. *How* a learner actively processes the material plays a large role; for



Motivation to learn doesn't make much of a difference unless learners use effective strategies for encoding the information they want to retain. Although they're not flashy, methods like spaced practice, interleaving, and frequent testing are among the most effective ways to apply your efforts. [Image: Cali4beach, <https://goo.gl/twjIVg>, CC BY 2.0, <https://goo.gl/BRvSA7>]

example, reading words and evaluating their meaning leads to better learning than reading them and evaluating the way that the words look or sound (**Craik & Lockhart, 1972**). These results suggest that individual differences in motivation will not have a large effect on learning unless learners also have accurate ideas about how to effectively learn material when they care to do so.

So, do learners know how to effectively encode material? People allowed to freely allocate their time to study a list of words do remember those words better than a group that doesn't have control over their own study time, though the advantage is relatively small and is limited to the subset of learners who choose to spend more time on the more difficult material (**Tullis & Benjamin, 2011**). In addition, learners who have an opportunity to review materials that they select for

restudy often learn more than another group that is asked to restudy the materials that they *didn't* select for restudy (**Kornell & Metcalfe, 2006**). However, this advantage also appears to be relatively modest (**Kimball, Smith, & Muntean, 2012**) and wasn't apparent in a group of older learners (**Tullis & Benjamin, 2012**). Taken together, all of the evidence seems to support the claim that self-control of learning can be effective, but only when learners have good ideas about what an effective learning strategy is.

One factor that appears to have a big effect and that learners do not always appear to understand is the effect of scheduling repetitions of study. If you are studying for a final exam next week and plan to spend a total of five hours, what is the best way to distribute your study? The evidence is clear that *spacing* one's repetitions apart in time is superior than *massing* them all together (**Baddeley & Longman, 1978; Bahrnick, Bahrnick, Bahrnick, & Bahrnick, 1993; Melton, 1967**). Increasing the spacing between consecutive presentations appears to benefit learning yet further (**Landauer & Bjork, 1978**).

A similar advantage is evident for the practice of interleaving multiple skills to be learned: For example, baseball batters improved more when they faced a mix of different types of pitches than when they faced the same pitches blocked by type (**Hall, Domingues, & Cavazos, 1994**). Students also showed better performance on a test when different types of mathematics problems were interleaved rather than blocked during learning (**Taylor & Rohrer, 2010**).

One final factor that merits discussion is the role of testing. Educators and students often think about testing as a way of assessing knowledge, and this is indeed an important use of tests. But tests themselves affect memory, because retrieval is one of the most powerful ways of enhancing learning (**Roediger & Butler, 2013**). Self-testing is an underutilized and potent means of making learning more durable.

General Principles of Learning

We've only begun to scratch the surface here of the many variables that affect the quality and content of learning (**Mullin, Herrmann, & Searleman, 1993**). But even within this brief examination of the differences between people and the activities they engage in can we see some basic principles of the learning process.

The value of effective metacognition

To be able to guide our own learning effectively, we must be able to evaluate the progress of our learning accurately and choose activities that enhance learning efficiently. It is of little use to study for a long time if a student cannot discern between what material she has or has not mastered, and if additional study activities move her no closer to mastery. **Metacognition** describes the knowledge and skills people have in monitoring and controlling their own learning and memory. We can work to acquire better metacognition by paying attention to our successes and failures in estimating what we do and don't know, and by using testing often to monitor our progress.

Transfer-appropriate processing

Sometimes, it doesn't make sense to talk about whether a particular encoding activity is good or bad for learning. Rather, we can talk about whether that activity is good for learning *as revealed by a particular test*. For example, although reading words for meaning leads to better performance on a test of recall or recognition than paying attention to the

pronunciation of the word, it leads to *worse* performance on a test that taps knowledge of that pronunciation, such as whether a previously studied word rhymes with another word (Morris, Bransford, & Franks, 1977). The principle of **transfer-appropriate processing** states that memory is “better” when the test taps the same type of knowledge as the original encoding activity. When thinking about how to learn material, we should always be thinking about the situations in which we are likely to need access to that material. An emergency responder who needs access to learned procedures under conditions of great stress should learn differently from a hobbyist learning to use a new digital camera.

The value of forgetting



In order to not forget things, we employ a variety of tricks (like scribbling a quick note on your hand). However, if we were unable to forget information, it would interfere with learning new or contradictory material. [Image: Andrea Maria Cannata, <https://goo.gl/yITbGG>, CC BY-NC 2.0, <https://goo.gl/qOP7mj>]

Forgetting is sometimes seen as the enemy of learning, but, in fact, forgetting is a highly desirable part of the learning process. The main bottleneck we face in using our knowledge is being able to access it. We have all had the experience of retrieval failure—that is, not being able to remember a piece of information that we know we have, and that we can access easily once the right set of cues is provided. Because access is difficult, it is important to jettison

information that is not needed—that is, to forget it. Without

forgetting, our minds would become cluttered with out-of-date or irrelevant information. And, just imagine how complicated life would be if we were unable to forget the names of past acquaintances, teachers, or romantic partners.

But the value of forgetting is even greater than that. There is lots of evidence that *some* forgetting is a prerequisite for *more* learning. For example, the previously discussed benefits of distributing practice opportunities may arise in part because of the greater forgetting that takes places between those spaced learning events. It is for this reason that some encoding activities that are difficult and lead to the appearance of slow learning actually lead to superior learning in the long run (Bjork, 2011). When we opt for learning activities that enhance learning quickly, we must be aware that these are not always the same techniques that lead to durable, long-term learning.

Conclusion

To wrap things up, let's think back to the questions we began the module with. What might you now do differently when preparing for an exam? Hopefully, you will think about testing yourself frequently, developing an accurate sense of what you do and do not know, how you are likely to use the knowledge, and using the scheduling of tasks to your advantage. If you are learning a new skill or new material, using the scientific study of learning as a basis for the study and practice decisions you make is a good bet.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily

address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Chunk

The process of grouping information together using our knowledge.

Classical conditioning

Describes stimulus-stimulus associative learning.

Encoding

The part of putting information into memory.

Habituation

Occurs when the response to a stimulus decreases with exposure.

Implicit learning

Occurs when we acquire information without intent that we cannot easily express.

Implicit memory

A type of long-term memory that does not require conscious thought to encode. It's the type of memory one makes without intent.

Incidental learning

Any type of learning that happens without the intention to learn.

Intentional learning

Any type of learning that happens when motivated by intention.

Metacognition

Describes the knowledge and skills people have in monitoring and controlling their own learning and memory.

Nonassociative learning

Occurs when a single repeated exposure leads to a change in behavior.

Operant conditioning

Describes stimulus-response associative learning.

Perceptual learning

Occurs when aspects of our perception changes as a function of experience.

Sensitization

Occurs when the response to a stimulus increases with exposure

Transfer-appropriate processing

A principle that states that memory performance is superior when a test taps the same cognitive processes as the original encoding activity.

Working memory

The form of memory we use to hold onto information temporarily, usually for the purposes of manipulation.

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PSYC 100 V

NEURONS

14. Neurons

Original chapter by Sharon Furtak adapted by the Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

This module on the biological basis of behavior provides an overview of the basic structure of neurons and their means of communication. Neurons, cells in the central nervous system, receive information from our sensory systems (vision, audition, olfaction, gustation, and somatosensation) about the world around us; in turn, they plan and execute appropriate behavioral responses, including attending to a stimulus, learning new information, speaking, eating, mating, and evaluating potential threats. The goal of this module is to become familiar with the anatomical structure of neurons and to understand how neurons communicate by electrochemical signals to process sensory information and produce complex behaviors through networks of neurons. Having a basic knowledge of the fundamental structure and function of neurons is a necessary foundation as you move forward in the field of psychology.

Learning Objectives

- Differentiate the functional roles between the two main cell classes in the brain, neurons and glia.
- Describe how the forces of diffusion and electrostatic pressure work collectively to facilitate electrochemical communication.
- Define resting membrane potential, excitatory postsynaptic potentials, inhibitory postsynaptic potentials, and action potentials.
- Explain features of axonal and synaptic communication in neurons.

Introduction

Imagine trying to string words together into a meaningful sentence without knowing the meaning of each word or its function (i.e., Is it a verb, a noun, or an adjective?). In a similar fashion, to appreciate how groups of cells work together in a meaningful way in the brain as a whole, we must first understand how individual cells in the brain function. Much like words, brain cells, called *neurons*, have an underlying structure that provides the foundation for their functional purpose. Have you ever seen a neuron? Did you know that the basic structure of a neuron is similar whether it is from the brain of a rat or a human? How do the billions of neurons in our brain allow us to do all the fun things we enjoy, such as texting a friend, cheering on our favorite sports team, or laughing?

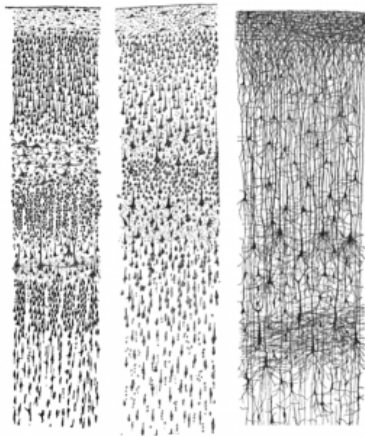


Figure 1. Three drawings by Santiago Ramón y Cajal, taken from “Comparative study of the sensory areas of the human cortex”, pages 314, 361, and 363. Left: Nissl-stained visual cortex of a human adult. Middle: Nissl-stained motor cortex of a human adult. Right: Golgi-stained cortex of a 1 1/2 month old infant. [Image: Santiago Ramon y Cajal, <https://goo.gl/zOb2I1>, CC0 Public Domain, <https://goo.gl/m25gce>]

Our journey in answering these questions begins more than 100 years ago with a scientist named Santiago Ramón y Cajal. Ramón y Cajal (1911) boldly concluded that discrete individual neurons are the structural and functional units of the nervous system. He based his conclusion on the numerous drawings he made of Golgi-stained tissue, a stain named after the scientist who discovered it, Camillo Golgi. Scientists use several types of stains to visualize cells. Each stain works in a unique way, which causes them to look differently when viewed under a microscope. For example, a very common

Nissl stain labels only the main part of the cell (i.e., the cell body; see left and middle panels of Figure 1). In contrast, a Golgi stain fills the cell body and all the processes that extend outward from it (see right panel of Figure 1). A more notable characteristic of a Golgi stain is that it only stains approximately 1–2% of neurons (Pasternak & Woolsey, 1975; Smit & Colon, 1969), permitting the observer to distinguish one cell from another. These qualities allowed Cajal to examine the full anatomical structure of individual neurons for the first time. This significantly enhanced our appreciation of the intricate networks their processes form. Based on his observation of Golgi-stained tissue, Cajal suggested neurons were distinguishable processing units rather than continuous

structures. This was in opposition to the dominant theory at the time proposed by Joseph von Gerlach, which stated that the nervous system was composed of a continuous network of nerves (for review see, **Lopez-Munoz, Boya, & Alamo, 2006**). Camillo Golgi himself had been an avid supporter of Gerlach's theory. Despite their scientific disagreement, Cajal and Camillo Golgi shared the Nobel Prize for Medicine in 1906 for their combined contribution to the advancement of science and our understanding of the structure of the nervous system. This seminal work paved the pathway to our current understanding of the basic structure of the nervous system described in this module (for review see: **De Carlos & Borrell, 2007; Grant, 2007**).

Before moving forward, there will be an introduction to some basic terminology regarding the anatomy of neurons in the section called "The Structure of the Neuron," below. Once we have reviewed this fundamental framework, the remainder of the module will focus on the electrochemical signals through which neurons communicate. While the electrochemical process might sound intimidating, it will be broken down into digestible sections. The first subsection, "Resting Membrane Potential," describes what occurs in a neuron at rest, when it is theoretically not receiving or sending signals. Building upon this knowledge, we will examine the electrical conductance that occurs within a single neuron when it receives signals. Finally, the module will conclude with a description of the electrical conductance, which results in communication between neurons through a release of chemicals. At the end of the module, you should have a broad concept of how each cell and large groups of cells send and receive information by electrical and chemical signals.

A note of encouragement: This module introduces a vast amount of technical terminology that at times may feel overwhelming. Do not get discouraged or bogged down in the details. Utilize the glossary at the end of the module as a quick reference guide; tab the glossary page so that you can easily

refer to it while reading the module. The glossary contains all terms in bold typing. Terms in italics are additional significant terms that may appear in other modules but are not contained within the glossary. On your first read of this module, I suggest focusing on the broader concepts and functional aspects of the terms instead of trying to commit all the terminology to memory. That is right, I said read first! I highly suggest reading this module at least twice, once prior to *and* again following the course lecture on this material. Repetition is the best way to gain clarity and commit to memory the challenging concepts and detailed vocabulary presented here.

The Structure of the Neuron

Basic Nomenclature

There are approximately 100 billion neurons in the human brain (**Williams & Herrup, 1988**). Each neuron has three main components: dendrites, the soma, and the axon (see Figure 2). **Dendrites** are processes that extend outward from the **soma**, or cell body, of a neuron and typically branch several times. Dendrites receive information from thousands of other neurons and are the main source of input of the neuron. The **nucleus**, which is located within the soma, contains genetic information, directs protein synthesis, and supplies the energy and the resources the neuron needs to function. The main source of output of the neuron is the **axon**. The axon is a process that extends far away from the soma and carries an important signal called an action potential to another neuron. The place at which the axon of one neuron comes in close contact to the dendrite of another neuron is a **synapse** (see Figures 2–3). Typically, the axon of a neuron is covered with an insulating substance called a **myelin sheath** that allows the

signal and communication of one neuron to travel rapidly to another neuron.

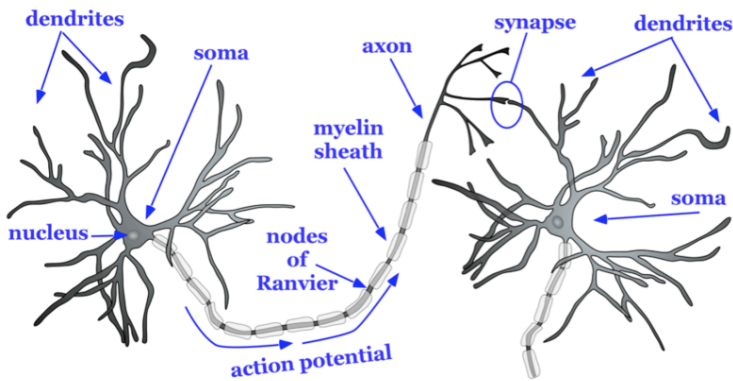


Figure 2. Basic structure of a neuron.

The axon splits many times, so that it can communicate, or synapse, with several other neurons (see Figure 2). At the end of the axon is a **terminal button**, which forms synapses with **spines**, or protrusions, on the dendrites of neurons. Synapses form between the *presynaptic* terminal button (neuron sending the signal) and the *postsynaptic membrane* (neuron receiving the signal; see Figure 3). Here we will focus specifically on synapses between the terminal button of an axon and a dendritic spine; however, synapses can also form between the terminal button of an axon and the soma or the axon of another neuron.

A very small space called a **synaptic gap** or a synaptic cleft, approximately 5 nm (nanometers), exists between the presynaptic terminal button and the postsynaptic dendritic spine. To give you a better idea of the size, a dime is 1.35 mm (millimeter) thick. There are 1,350,000 nm in the thickness of a dime. In the presynaptic terminal button, there are **synaptic vesicles** that package together groups of chemicals called

neurotransmitters (see Figure 3). Neurotransmitters are released from the presynaptic terminal button, travel across the synaptic gap, and activate ion channels on the postsynaptic spine by binding to *receptor sites*. We will discuss the role of receptors in more detail later in the module.

Types of Cells in the Brain

Not all neurons are created equal! There are neurons that help us receive information about the world around us, *sensory* neurons. There are *motor* neurons that allow us to initiate movement and behavior, ultimately allowing us to interact with the world around us. Finally, there are *interneurons*, which process the sensory input from our environment into meaningful representations, plan the appropriate behavioral response, and connect to the motor neurons to execute these behavioral plans.

There are three main categories of neurons, each defined by its specific structure. The structures of these three different types of neurons support their unique functions. *Unipolar neurons* are structured in such a way that is ideal for relaying information forward, so they have one neurite (axon) and no dendrites. They are involved in transmission of physiological information from the body's periphery such as communicating body temperature through the spinal cord up to the brain. *Bipolar neurons* are involved in sensory perception such as perception of light in the retina of the eye. They have one axon and one dendrite which help acquire and pass sensory information to various centers in the brain. Finally, *multipolar neurons* are the most common and they communicate sensory and motor information in the brain. For example, their firing causes muscles in the body to contract. Multipolar neurons have one axon and many dendrites which allows them to communicate with other neurons. One of the most

prominent neurons is a pyramidal neuron, which falls under the multipolar category. It gets its name from the triangular or pyramidal shape of its soma (for examples see, **Furtak, Moyer, & Brown, 2007**).

In addition to neurons, there is a second type of cell in the brain called *glia* cells. Glia cells have several functions, just a few of which we will discuss here. One type of glia cell, called *oligodendroglia*, forms the myelin sheaths mentioned above (**Simons & Trotter,**

2007; see Fig. 2). Oligodendroglia wrap their dendritic processes around the axons of neurons many times to form the myelin sheath. One cell will form the myelin sheath on several axons. Other types of glia cells, such as *microglia* and *astrocytes*, digest debris of dead neurons, carry nutritional support from blood vessels to the neurons, and help to regulate the ionic composition of the extracellular fluid. While glial cells play a vital role in neuronal support, they do not participate in the communication between cells in the same fashion as neurons do.

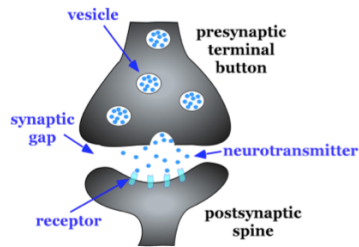


Figure 3. Characteristics of a synapse.

Communication Within and Between Neurons

Thus far, we have described the main characteristics of neurons, including how their processes come in close contact with one another to form *synapses*. In this section, we consider the conduction of communication within a neuron and how this signal is transmitted to the next neuron. There are two

stages of this electrochemical action in neurons. The first stage is the electrical conduction of dendritic input to the initiation of an action potential within a neuron. The second stage is a chemical transmission across the synaptic gap between the presynaptic neuron and the postsynaptic neuron of the synapse. To understand these processes, we first need to consider what occurs within a neuron when it is at a steady state, called *resting membrane potential*.

Resting Membrane Potential

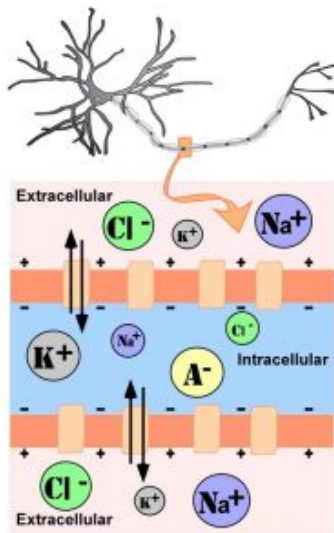


Figure 4. Representation of ion concentrations inside (intracellular) and outside (extracellular) a neuron in the unmyelinated segment of the axon.

The intracellular (inside the cell) fluid and extracellular (outside the cell) fluid of neurons is composed of a combination of ions (electrically charged molecules; see Figure 4). Cations are positively charged ions, and anions are negatively charged ions. The composition of intracellular and extracellular fluid is similar to salt water, containing sodium (Na^+), potassium (K^+), chloride (Cl^-), and anions (A^-).

The **cell membrane**, which is composed of a lipid bilayer of fat molecules, separates the cell from the surrounding

extracellular fluid. There are proteins that span the membrane, forming **ion channels** that allow particular ions to pass between the intracellular and extracellular fluid (see Figure 4).

These ions are in different concentrations inside the cell relative to outside the cell, and the ions have different electrical charges. Due to this difference in concentration and charge, two forces act to maintain a steady state when the cell is at rest: diffusion and electrostatic pressure. **Diffusion** is the force on molecules to move from areas of high concentration to areas of low concentration. **Electrostatic pressure** is the force on two ions with similar charge to repel each other and the force of two ions with opposite charge to attract to one another. Remember the saying, opposites attract?

Regardless of the ion, there exists a membrane potential at which the force of diffusion is equal and opposite of the force of electrostatic pressure. This voltage, called the *equilibrium potential*, is the voltage at which no ions flow. Since there are several ions that can permeate the cell's membrane, the baseline electrical charge inside the cell compared with outside the cell, referred to as **resting membrane potential**, is based on the collective drive of force on several ions. Relative to the extracellular fluid, the membrane potential of a neuron at rest is negatively charged at approximately -70 mV (see Figure 5). These are very small voltages compared with the voltages of batteries and electrical outlets, which we encounter daily, that range from 1.5 to 240 V.

Let us see how these two forces, diffusion and electrostatic pressure, act on the four groups of ions mentioned above.

1. *Anions (A⁻)*: Anions are highly concentrated inside the cell and contribute to the negative charge of the resting membrane potential. Diffusion and electrostatic pressure are not forces that determine A⁻ concentration because A⁻ is impermeable to the cell membrane. There are no ion channels that allow for A⁻ to move between the intracellular and extracellular fluid.
2. *Potassium (K⁺)*: The cell membrane is very permeable to potassium at rest, but potassium remains in high

concentrations inside the cell. Diffusion pushes K^+ outside the cell because it is in high concentration inside the cell. However, electrostatic pressure pushes K^+ inside the cell because the positive charge of K^+ is attracted to the negative charge inside the cell. In combination, these forces oppose one another with respect to K^+ .

3. *Chloride (Cl^-):* The cell membrane is also very permeable to chloride at rest, but chloride remains in high concentration outside the cell. Diffusion pushes Cl^- inside the cell because it is in high concentration outside the cell. However, electrostatic pressure pushes Cl^- outside the cell because the negative charge of Cl^- is attracted to the positive charge outside the cell. Similar to K^+ , these forces oppose one another with respect to Cl^- .
4. *Sodium (Na^+):* The cell membrane is not very permeable to sodium at rest. Diffusion pushes Na^+ inside the cell because it is in high concentration outside the cell. Electrostatic pressure also pushes Na^+ inside the cell because the positive charge of Na^+ is attracted to the negative charge inside the cell. Both of these forces push Na^+ inside the cell; however, Na^+ cannot permeate the cell membrane and remains in high concentration outside the cell. The small amounts of Na^+ inside the cell are removed by a **sodium-potassium pump**, which uses the neuron's energy (adenosine triphosphate, ATP) to pump 3 Na^+ ions out of the cell in exchange for bringing 2 K^+ ions inside the cell.

Action Potential

Now that we have considered what occurs in a neuron at rest, let us consider what changes occur to the resting membrane potential when a neuron receives input, or information, from the presynaptic terminal button of another neuron. Our

understanding of the electrical signals or potentials that occurs within a neuron results from the seminal work of Hodgkin and Huxley that began in the 1930s at a well-known marine biology lab in Woodshole, MA. Their work, for which they won the Nobel Prize in Medicine in 1963, has resulted in the general model of electrochemical transduction that is described here (**Hodgkin & Huxley, 1952**). Hodgkin and Huxley studied a very large axon in the squid, a common species for that region of the United States. The giant axon of the squid is roughly 100 times larger than that of axons in the mammalian brain, making it much easier to see. Activation of the giant axon is responsible for a withdrawal response the squid uses when trying to escape from a predator, such as large fish, birds, sharks, and even humans. When was the last time you had calamari? The large axon size is no mistake in nature's design; it allows for very rapid transmission of an electrical signal, enabling a swift escape motion in the squid from its predators.

While studying this species, Hodgkin and Huxley noticed that if they applied an electrical stimulus to the axon, a large, transient electrical current conducted down the axon. This transient electrical current is known as an **action potential** (see Figure 5). An action potential is an all-or-nothing response that occurs when there is a change in the charge or potential of the cell from its resting membrane potential (-70 mV) in a more positive direction, which is a *depolarization* (see Figure 5). What is meant by an all-or-nothing response? I find that this concept is best compared to the binary code used in computers, where there are only two possibilities, 0 or 1. There is no halfway or in-between these possible values; for example, 0.5 does not exist in binary code. There are only two possibilities, either the value of 0 or the value of 1. The action potential is the same in this respect. There is no halfway; it occurs, or it does not occur. There is a specific membrane potential that the neuron must reach to initiate an action potential. This membrane potential, called the **threshold of**

excitation, is typically around -50 mV. If the threshold of excitation is reached, then an action potential is triggered.

How is an action potential initiated? At any one time, each neuron is receiving hundreds of inputs from the cells that synapse with it. These inputs can cause several types of fluctuations in the neuron's membrane potentials (see Figure 5):

1. **excitatory postsynaptic potentials (EPSPs)**: a *depolarizing* current that causes the membrane potential to become more positive and closer to the threshold of excitation; or
2. **inhibitory postsynaptic potentials (IPSPs)**: a *hyperpolarizing* current that causes the membrane potential to become more negative and further away from the threshold of excitation.

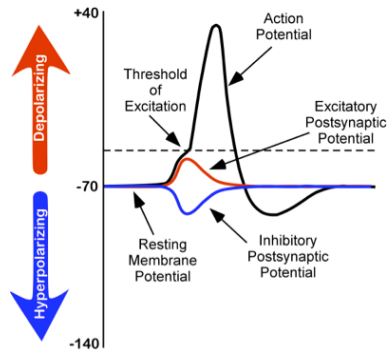


Figure 5. Changes in membrane potentials of neurons.

These postsynaptic potentials, EPSPs and IPSPs, *summate* or add together in time and space. The IPSPs make the membrane potential more negative, but how much so depends on the strength of the IPSPs. The EPSPs make the membrane potential more positive; again, how much more positive depends on the strength of the EPSPs. If you have two small EPSPs at the same time and the same synapse then the result will be a large EPSP. If you have a small EPSP and a small IPSP at the same time and the same synapse then they will cancel each other out. Unlike the action potential, which is an all-or-nothing response, IPSPs and EPSPs are smaller and *graded* potentials, varying in strength. The change in voltage

during an action potential is approximately 100 mV. In comparison, EPSPs and IPSPs are changes in voltage between 0.1 to 40 mV. They can be different strengths, or gradients, and they are measured by how far the membrane potentials diverge from the resting membrane potential.

I know the concept of summation can be confusing. As a child, I use to play a game in elementary school with a very large parachute where you would try to knock balls out of the center of the parachute. This game illustrates the properties of summation rather well. In this game, a group of children next to one another would work in unison to produce waves in the parachute in order to cause a wave large enough to knock the ball out of the parachute. The children would initiate the waves at the same time and in the same direction. The additive result was a larger wave in the parachute, and the balls would bounce out of the parachute. However, if the waves they initiated occurred in the opposite direction or with the wrong timing, the waves would cancel each other out, and the balls would remain in the center of the parachute. EPSPs or IPSPs in a neuron work in the same fashion to the properties of the waves in the parachute; they either add or cancel each other out. If you have two EPSPs, then they sum together and become a larger depolarization. Similarly, if two IPSPs come into the cell at the same time, they will sum and become a larger hyperpolarization in membrane potential. However, if two inputs were opposing one another, moving the potential in opposite directions, such as an EPSP and an IPSP, their sum would cancel each other out.

At any moment in time, each cell is receiving mixed messages, both EPSPs and IPSPs. If the summation of EPSPs is strong enough to depolarize the membrane potential to reach the threshold of excitation, then it initiates an action potential. The action potential then travels down the axon, away from the soma, until it reaches the ends of the axon (the terminal button). In the terminal button, the action potential triggers

the release of neurotransmitters from the presynaptic terminal button into the synaptic gap. These neurotransmitters, in turn, cause EPSPs and IPSPs in the postsynaptic dendritic spines of the next cell (see Figures 4 & 6). The neurotransmitter released from the presynaptic terminal button binds with **ionotropic receptors** in a lock-and-key fashion on the post-synaptic dendritic spine. Ionotropic receptors are receptors on ion channels that open, allowing some ions to enter or exit the cell, depending upon the presence of a particular neurotransmitter. The type of neurotransmitter and the permeability of the ion channel it activates will determine if an EPSP or IPSP occurs in the dendrite of the post-synaptic cell. These EPSPs and IPSPs summate in the same fashion described above and the entire process occurs again in another cell.

The Change in Membrane Potential During an Action Potential

We discussed previously which ions are involved in maintaining the resting membrane potential. Not surprisingly, some of these same ions are involved in the action potential. When the cell becomes depolarized (more positively charged) and reaches the threshold of excitation, this causes a voltage-dependent Na^+ channel to open. A voltage-dependent ion channel is a channel that opens, allowing some ions to enter or exit the cell, depending upon when the cell reaches a particular membrane potential. When the cell is at resting membrane potential, these voltage-dependent Na^+ channels are closed. As we learned earlier, both diffusion and electrostatic pressure are pushing Na^+ inside the cells. However, Na^+ cannot permeate the membrane when the cell is at rest. Now that these channels are open, Na^+ rushes inside the cell, causing the cell to become very positively charged relative to the

outside of the cell. This is responsible for the rising or depolarizing phase of the action potential (see Figure 5). The inside of the cell becomes very positively charged, +40mV. At this point, the Na⁺ channels close and become *refractory*. This means the Na⁺ channels cannot reopen again until after the cell returns to the resting membrane potential. Thus, a new action potential cannot occur during the refractory period. The refractory period also ensures the action potential can only move in one direction down the axon, away from the soma. As the cell becomes more depolarized, a second type of voltage-dependent channel opens; this channel is permeable to K⁺. With the cell very positive relative to the outside of the cell (depolarized) and the high concentration of K⁺ within the cell, both the force of diffusion and the force of electrostatic pressure drive K⁺ outside of the cell. The movement of K⁺ out of the cell causes the cell potential to return back to the resting membrane potential, the falling or hyperpolarizing phase of the action potential (see Figure 5). A short hyperpolarization occurs partially due to the gradual closing of the K⁺ channels. With the Na⁺ closed, electrostatic pressure continues to push K⁺ out of the cell. In addition, the sodium-potassium pump is pushing Na⁺ out of the cell. The cell returns to the resting membrane potential, and the excess extracellular K⁺ diffuses away. This exchange of Na⁺ and K⁺ ions happens very rapidly, in less than 1 msec. The action potential occurs in a wave-like motion down the axon until it reaches the terminal button. Only the ion channels in very close proximity to the action potential are affected.

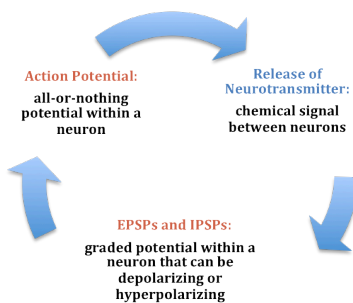


Figure 6. Summary of the electrochemical communication within and between neurons.

Earlier you learned that axons are covered in myelin. Let us consider how myelin speeds up the process of the action potential. There are gaps in the myelin sheaths called *nodes of Ranvier*. The myelin insulates the axon and does not allow any fluid to exist between the myelin and cell membrane. Under the myelin, when the Na^+

and K^+ channels open, no ions flow between the intracellular and extracellular fluid. This saves the cell from having to expend the energy necessary to rectify or regain the resting membrane potential. (Remember, the pumps need ATP to run.) Under the myelin, the action potential degrades some, but is still large enough in potential to trigger a new action potential at the next node of Ranvier. Thus, the action potential actively jumps from node to node; this process is known as *saltatory conduction*.

In the presynaptic terminal button, the action potential triggers the release of neurotransmitters (see Figure 3). Neurotransmitters cross the synaptic gap and open subtypes of receptors in a lock-and-key fashion (see Figure 3). Depending on the type of neurotransmitter, an EPSP or IPSP occurs in the dendrite of the post-synaptic cell. Neurotransmitters that open Na^+ or calcium (Ca^+) channels cause an EPSP; an example is the NMDA receptors, which are activated by glutamate (the main excitatory neurotransmitter in the brain). In contrast, neurotransmitters that open Cl^- or K^+ channels cause an IPSP; an example is gamma-aminobutyric acid (GABA) receptors, which are activated by GABA, the main inhibitory neurotransmitter in the brain. Once the EPSPs and IPSPs occur in the postsynaptic site, the process of communication within

and between neurons cycles on (see Figure 6). A neurotransmitter that does not bind to receptors is broken down and inactivated by enzymes or glial cells, or it is taken back into the presynaptic terminal button in a process called *reuptake*, which will be discussed further in the module on psychopharmacology.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Action potential

A transient all-or-nothing electrical current that is conducted down the axon when the membrane potential reaches the threshold of excitation.

Axon

Part of the neuron that extends off the soma, splitting several times to connect with other neurons; main output of the neuron.

Cell membrane

A bi-lipid layer of molecules that separates the cell from the surrounding extracellular fluid.

Dendrite

Part of a neuron that extends away from the cell body and is the main input to the neuron.

Diffusion

The force on molecules to move from areas of high concentration to areas of low concentration.

Electrostatic pressure

The force on two ions with similar charge to repel each other; the force of two ions with opposite charge to attract to one another.

Excitatory postsynaptic potentials

A depolarizing postsynaptic current that causes the membrane potential to become more positive and move towards the threshold of excitation.

Inhibitory postsynaptic potentials

A hyperpolarizing postsynaptic current that causes the membrane potential to become more negative and move away from the threshold of excitation.

Ion channels

Proteins that span the cell membrane, forming channels that specific ions can flow through between the intracellular and extracellular space.

Ionotropic receptor

Ion channel that opens to allow ions to permeate the cell membrane under specific conditions, such as the presence of a neurotransmitter or a specific membrane potential.

Myelin sheath

Substance around the axon of a neuron that serves as insulation to allow the action potential to conduct rapidly toward the terminal buttons.

Neurotransmitters

Chemical substance released by the presynaptic terminal button that acts on the postsynaptic cell.

Nucleus

Collection of nerve cells found in the brain which typically serve a specific function.

Resting membrane potential

The voltage inside the cell relative to the voltage outside the cell while the cell is at rest (approximately -70 mV).

Sodium-potassium pump

An ion channel that uses the neuron's energy (adenosine triphosphate, ATP) to pump three Na⁺ ions outside the cell in exchange for bringing two K⁺ ions inside the cell.

Soma

Cell body of a neuron that contains the nucleus and genetic information, and directs protein synthesis.

Spines

Protrusions on the dendrite of a neuron that form synapses with terminal buttons of the presynaptic axon.

Synapse

Junction between the presynaptic terminal button of one neuron and the dendrite, axon, or soma of another postsynaptic neuron.

Synaptic gap

Also known as the synaptic cleft; the small space between the presynaptic terminal button and the postsynaptic dendritic spine, axon, or soma.

Synaptic vesicles

Groups of neurotransmitters packaged together and located within the terminal button.

Terminal button

The part of the end of the axon that form synapses with postsynaptic dendrite, axon, or soma.

Threshold of excitation

Specific membrane potential that the neuron must reach to initiate an action potential.

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15. Hormones and Behavior

Original chapter Randy J. Nelson adapted by the Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

The goal of this module is to introduce you to the topic of hormones and behavior. This field of study is also called behavioral endocrinology, which is the scientific study of the interaction between hormones and behavior. This interaction is bidirectional: hormones can influence behavior, and behavior can sometimes influence hormone concentrations. Hormones are chemical messengers released from endocrine glands that travel through the blood system to influence the nervous system to regulate behaviors such as aggression, mating, and parenting of individuals.

Learning Objectives

- Define the basic terminology and basic principles of hormone–behavior interactions.

- Explain the role of hormones in behavioral sex differentiation.
- Explain the role of hormones in aggressive behavior.
- Explain the role of hormones in parental behavior.
- Provide examples of some common hormone-behavior interactions.

Introduction

This module describes the relationship between hormones and behavior. Many readers are likely already familiar with the general idea that hormones can affect behavior. Students are generally familiar with the idea that sex-hormone concentrations increase in the blood during puberty and decrease as we age, especially after about 50 years of age. Sexual behavior shows a similar pattern. Most people also know about the relationship between aggression and anabolic steroid hormones, and they know that administration of artificial steroid hormones sometimes results in uncontrollable, violent behavior called “roid rage.” Many different hormones can influence several types of behavior, but for the purpose of this module, we will restrict our discussion to just a few examples of hormones and behaviors. For example, are behavioral sex differences the result of hormones, the environment, or some combination of factors? Why are men much more likely than women to commit aggressive acts? Are hormones involved in mediating the so-called maternal “instinct”? Behavioral endocrinologists are interested in how the general physiological effects of hormones alter the development and expression of behavior and how behavior may influence the effects of hormones. This module describes, both phenomenologically and functionally, how hormones affect behavior.

To understand the hormone-behavior relationship, it is

important briefly to describe hormones. **Hormones** are organic chemical messengers produced and released by specialized glands called **endocrine glands**. Hormones are released from these glands into the blood, where they may travel to act on target structures at some distance from their origin. Hormones are similar in function to **neurotransmitters**, the chemicals used by the nervous system in coordinating animals' activities. However, hormones can operate over a greater distance and over a much greater temporal range than neurotransmitters (Focus Topic 1). Examples of hormones that influence behavior include steroid hormones such as **testosterone** (a common type of androgen), estradiol (a common type of estrogen), progesterone (a common type of **progestin**), and cortisol (a common type of glucocorticoid) (Table 1, A-B). Several types of protein or peptide (small protein) hormones also influence behavior, including **oxytocin**, vasopressin, **prolactin**, and leptin.

Focus Topic 1: Neural Transmission versus Hormonal Communication

Although neural and hormonal communication both rely on chemical signals, several prominent differences exist. Communication in the nervous system is analogous to traveling on a train. You can use the train in your travel plans as long as tracks exist between your proposed origin and destination. Likewise, neural messages can travel only to destinations along existing nerve tracts. Hormonal communication, on the other hand, is like traveling in a car. You can drive to many more destinations

than train travel allows because there are many more roads than railroad tracks. Similarly, hormonal messages can travel anywhere in the body via the circulatory system; any cell receiving blood is potentially able to receive a hormonal message. Neural and hormonal communication differ in other ways as well. To illustrate them, consider the differences between digital and analog technologies. Neural messages are digital, all-or-none events that have rapid onset and offset: neural signals can take place in milliseconds. Accordingly, the nervous system mediates changes in the body that are relatively rapid. For example, the nervous system regulates immediate food intake and directs body movement. In contrast, hormonal messages are analog, graded events that may take seconds, minutes, or even hours to occur. Hormones can mediate long-term processes, such as growth, development, reproduction, and metabolism. Hormonal and neural messages are both chemical in nature, and they are released and received by cells in a similar manner; however, there are important differences as well. Neurotransmitters, the chemical messengers used by neurons, travel a distance of only 20–30 nanometers (30×10^{-9} m)—to the membrane of the postsynaptic neuron, where they bind with receptors. Hormones enter the circulatory system and may travel from 1 millimeter to >2 meters before arriving at a target cell, where they bind with specific receptors. Another distinction between neural and hormonal communication is the degree

of voluntary control that can be exerted over their functioning. In general, there is more voluntary control of neural than of hormonal signals. It is virtually impossible to will a change in your thyroid hormone levels, for example, whereas moving your limbs on command is easy. Although these are significant differences, the division between the nervous system and the endocrine system is becoming more blurred as we learn more about how the nervous system regulates hormonal communication. A better understanding of the interface between the endocrine system and the nervous system, called neuroendocrinology, is likely to yield important advances in the future study of the interaction between hormones and behavior.

Steroid Hormones	
Cortisol	Increases carbohydrate metabolism; mediates stress responses
Estradiol	Uterine and other female tissue development; regulates sexual motivation and performance in females and males
Testosterone	Promotes sperm production and male secondary sexual characteristics; promotes sexual motivation and behavior, typically by being converted to estradiol

Table 1-A: Prominent Hormones That Influence Behavior

Peptides and Protein Hormones	
Oxytocin	Stimulates milk letdown and uterine contractions during birth; Promotes social bonding
Prolactin	Many actions relating to reproduction, water balance, and behavior associated with parental care
Thyroxine	Increases oxidation rates in tissue and affects neural development
Vasopressin	Increases water reabsorption in the kidney and affects learning and memory

Table 1-B: Prominent Hormones That Influence Behavior

Hormones coordinate the physiology and behavior of individuals by regulating, integrating, and controlling bodily functions. Over evolutionary time, hormones have often been co-opted by the nervous system to influence behavior to ensure reproductive success. For example, the same hormones, testosterone and estradiol, that cause gamete (egg or sperm) maturation also promote mating behavior. This dual hormonal function ensures that mating behavior occurs when animals have mature gametes available for fertilization. Another example of endocrine regulation of physiological and behavioral function is provided by pregnancy. Estrogens and progesterone concentrations are elevated during pregnancy, and these hormones are often involved in mediating maternal behavior in the mothers.

Not all cells are influenced by each and every hormone. Rather, any given hormone can directly influence only cells that have specific hormone receptors for that particular hormone. Cells that have these specific receptors are called **target cells** for the hormone. The interaction of a hormone with its receptor begins a series of cellular events that eventually lead to activation of enzymatic pathways or, alternatively, turns on or turns off gene activation that regulates protein synthesis. The newly synthesized proteins may activate or deactivate other genes, causing yet another cascade of cellular events.

Importantly, sufficient numbers of appropriate hormone receptors must be available for a specific hormone to produce any effects. For example, testosterone is important for male sexual behavior. If men have too little testosterone, then sexual motivation may be low, and it can be restored by testosterone treatment. However, if men have normal or even elevated levels of testosterone yet display low sexual drive, then it might be possible for a lack of receptors to be the cause and treatment with additional hormones will not be effective.

How might hormones affect behavior? In terms of their behavior, one can think of humans and other animals conceptually as comprised of three interacting components: (1) input systems (sensory systems), (2) integrators (the central nervous system), and (3) output systems, or effectors (e.g., muscles). Hormones do not *cause* behavioral changes. Rather, hormones influence these three systems so that specific stimuli are more likely to elicit certain responses in the appropriate behavioral or social context. In other words, hormones change the probability that a particular behavior will be emitted in the appropriate situation (**Nelson, 2011**). This is a critical distinction that can affect how we think of hormone-behavior relationships.

We can apply this three-component behavioral scheme to a simple behavior, singing in zebra finches. Only male zebra finches sing. If the testes of adult male finches are removed, then the birds reduce singing, but castrated finches resume singing if the testes are reimplanted, or if the birds are treated with either testosterone or estradiol. Although we commonly consider androgens to be “male” hormones and estrogens to be “female” hormones, it is common for testosterone to be converted to estradiol in nerve cells (Figure 1). Thus, many male-like behaviors are associated with the actions of estrogens! Indeed, all estrogens must first be converted from androgens because of the typical biochemical synthesis process. If the converting enzyme is low or missing, then it

is possible for females to produce excessive androgens and subsequently develop associated male traits. It is also possible for estrogens in the environment to affect the nervous system of animals, including people (e.g., **Kidd et al., 2007**). Again, singing behavior is most frequent when blood testosterone or estrogen concentrations are high. Males sing to attract mates or ward off potential competitors from their territories.

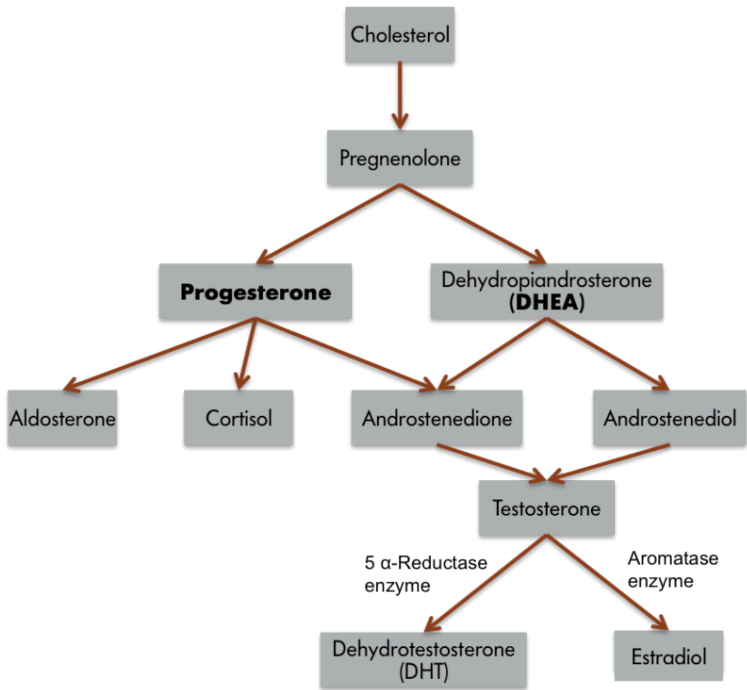


Figure 1: Biochemical Pathway for Steroid Hormone Synthesis: It is important to note that testosterone (an androgen) can be converted to another androgen, DHT, or an estrogen, estradiol. Too much or too little of the converting enzymes can influence brain and behavior.

Although it is apparent from these observations that estrogens are somehow involved in singing, how might the three-component framework just introduced help us to formulate

hypotheses to explore estrogen's role in this behavior? By examining input systems, we could determine whether estrogens alter the birds' sensory capabilities, making the environmental cues that normally elicit singing more salient. If this were the case, then females or competitors might be more easily seen or heard. Estrogens also could influence the central nervous system. Neuronal architecture or the speed of neural processing could change in the presence of estrogens. Higher neural processes (e.g., motivation, attention, or perception) also might be influenced. Finally, the effector organs, muscles in this case, could be affected by the presence of estrogens. Blood estrogen concentrations might somehow affect the muscles of a songbird's syrinx (the vocal organ of birds). Estrogens, therefore, could affect birdsong by influencing the sensory capabilities, central processing system, or effector organs of an individual bird. We do not understand completely how estrogen, derived from testosterone, influences birdsong, but in most cases, hormones can be considered to affect behavior by influencing one, two, or all three of these components, and this three-part framework can aid in the design of hypotheses and experiments to explore these issues.

How might behaviors affect hormones? The birdsong example demonstrates how hormones can affect behavior, but as noted, the reciprocal relation also occurs; that is, behavior can affect hormone concentrations. For example, the sight of a territorial intruder may elevate blood testosterone concentrations in resident male birds and thereby stimulate singing or fighting behavior. Similarly, male mice or rhesus monkeys that lose a fight decrease circulating testosterone concentrations for several days or even weeks afterward. Comparable results have also been reported in humans. Testosterone concentrations are affected not only in humans involved in physical combat, but also in those involved in simulated battles. For example, testosterone concentrations

were elevated in winners and reduced in losers of regional chess tournaments.



The expectation of events can influence one's hormonal activity. How do you think yours is affected if you anticipate going on a date with a romantic interest soon?
[Image: CCO Public Domain, <https://goo.gl/m25gce>]

People do not have to be directly involved in a contest to have their hormones affected by the outcome of the contest. Male fans of both the Brazilian and Italian teams were recruited to provide saliva samples to be assayed for testosterone before and after the final game of the World Cup soccer match in 1994. Brazil and Italy were tied going into the final game, but Brazil won on a penalty kick at the last possible moment. The Brazilian fans were elated

and the Italian fans were crestfallen. When the samples were assayed, 11 of 12 Brazilian fans who were sampled had increased testosterone concentrations, and 9 of 9 Italian fans had decreased testosterone concentrations, compared with pre-game baseline values (**Dabbs, 2000**).

In some cases, hormones can be affected by anticipation of behavior. For example, testosterone concentrations also influence sexual motivation and behavior in women. In one study, the interaction between sexual intercourse and testosterone was compared with other activities (cuddling or exercise) in women (**van Anders, Hamilton, Schmidt, & Watson, 2007**). On three separate occasions, women provided a pre-activity, post-activity, and next-morning saliva sample. After analysis, the women's testosterone was determined to be elevated prior to intercourse as compared to other times. Thus, an anticipatory relationship exists between sexual behavior

and testosterone. Testosterone values were higher post-intercourse compared to exercise, suggesting that engaging in sexual behavior may also influence hormone concentrations in women.

Sex Differences

Hens and roosters are different. Cows and bulls are different. Men and women are different. Even girls and boys are different. Humans, like many animals, are sexually dimorphic (*di*, “two”; *morph*, “type”) in the size and shape of their bodies, their physiology, and for our purposes, their behavior. The behavior of boys and girls differs in many ways. Girls generally excel in verbal abilities relative to boys; boys are nearly twice as likely as girls to have dyslexia (reading difficulties) and stuttering and nearly 4 times more likely to be diagnosed with autism. Boys are generally better than girls at tasks that require visuospatial abilities. Girls engage in nurturing behaviors more frequently than boys. More than 90% of all anorexia nervosa cases involve young women. Young men are twice as likely as young women to have schizophrenia. Boys are much more aggressive and generally engage in more rough-and-tumble play than girls (**Berenbaum, Martin, Hanish, Briggs, & Fabes, 2008**). Many sex differences, such as the difference in aggressiveness, persist throughout adulthood. For example, there are many more men than women serving prison sentences for violent behavior. The hormonal differences between men and women may account for adult sex differences that develop during puberty, but what accounts for behavioral sex differences among children *prior* to puberty and activation of their gonads? Hormonal secretions from the developing gonads determine whether the individual develops in a male or female manner. The mammalian embryonic testes produce androgens, as well as peptide hormones, that steer the development of the body, central

nervous system, and subsequent behavior in a male direction. The embryonic ovaries of mammals are virtually quiescent and do not secrete high concentrations of hormones. In the presence of ovaries, or in the complete absence of any gonads, morphological, neural, and, later, behavioral development follows a female pathway.

Gonadal steroid hormones have organizational (or programming) effects upon brain and behavior (Phoenix, Goy, Gerall, & Young, 1959). The organizing effects of steroid hormones are relatively constrained to the early stages of development. An asymmetry exists in the effects of testes and ovaries on the organization of behavior in mammals. Hormone exposure early in life has organizational effects on subsequent rodent behavior; early steroid hormone treatment causes relatively irreversible and



Sex differences in appearance are often more pronounced in nonhuman animals than in humans. Male birds particularly, for example roosters, tend to have physical features that differ from the females and also differ significantly in size. [Image: John Cudworth, <https://goo.gl/oopnqM>, CC BY-NC 2.0, <https://goo.gl/VnKlK8>]

permanent **masculinization** of rodent behavior (mating and aggressive). These early hormone effects can be contrasted with the reversible behavioral influences of steroid hormones provided in adulthood, which are called activational effects. The activational effects of hormones on adult behavior are temporary and may wane soon after the hormone is metabolized. Thus, typical male behavior requires exposure to androgens during gestation (in humans) or immediately after birth (in rodents) to somewhat masculinize the brain and also requires androgens during or after puberty to activate these

neural circuits. Typical female behavior requires a lack of exposure to androgens early in life which leads to **feminization** of the brain and also requires estrogens to activate these neural circuits in adulthood. But this simple dichotomy, which works well with animals with very distinct sexual dimorphism in behavior, has many caveats when applied to people.

If you walk through any major toy store, then you will likely observe a couple of aisles filled with pink boxes and the complete absence of pink packaging of toys in adjacent aisles. Remarkably, you will also see a strong self-segregation of boys and girls in these aisles. It is rare to see boys in the “pink” aisles and vice versa. The toy manufacturers are often accused of making toys that are gender biased, but it seems more likely that boys and girls enjoy playing with specific types and colors of toys. Indeed, toy manufacturers would immediately double their sales if they could sell toys to both sexes. Boys generally prefer toys such as trucks and balls and girls generally prefer toys such as dolls. Although it is doubtful that there are genes that encode preferences for toy cars and trucks on the Y chromosome, it is possible that hormones might shape the development of a child’s brain to prefer certain types of toys or styles of play behavior. It is reasonable to believe that children learn which types of toys and which styles of play are appropriate to their gender. How can we understand and separate the contribution of physiological mechanisms from learning to understand sex differences in human behaviors? To untangle these issues, animal models are often used. Unlike the situation in humans, where sex differences are usually only a matter of degree (often slight), in some animals, members of only one sex may display a particular behavior. As noted, often only male songbirds sing. Studies of such strongly sex-biased behaviors are particularly valuable for understanding the interaction among behavior, hormones, and the nervous system.

A study of vervet monkeys calls into question the primacy of

learning in the establishment of toy preferences (**Alexander & Hines, 2002**). Female vervet monkeys preferred girl-typical toys, such as dolls or cooking pots, whereas male vervet monkeys preferred boy-typical toys, such as cars or balls. There were no sex differences in preference for gender-neutral toys, such as picture books or stuffed animals. Presumably, monkeys have no prior concept of “boy” or “girl” toys. Young rhesus monkeys also show similar toy preferences.



If you think back to the toys and clothing you played with and wore in your youth, do you think they were more a result of your hormonal activity or the choices that society and your parents made for you? [Image: CC0 Public Domain, <https://goo.gl/m25gce>]

What then underlies the sex difference in toy preference? It is possible that certain attributes of toys (or objects) appeal to either boys or girls. Toys that appeal to boys or male vervet or rhesus monkeys, in this case, a ball or toy car, are objects that can be moved actively through space, toys that can be incorporated into active, rough and tumble play. The appeal of toys that girls or female vervet monkeys prefer appears to be based on color. Pink and red (the

colors of the doll and pot) may provoke attention to infants.

Society may reinforce such stereotypical responses to gender-typical toys. The sex differences in toy preferences emerge by 12 or 24 months of age and seem fixed by 36 months of age, but are sex differences in toy preference present during the first year of life? It is difficult to ask pre-verbal infants what they prefer, but in studies where the investigators examined the amount of time that babies looked at different toys, eye-tracking data indicate that infants as young as 3 months showed sex differences in toy preferences;

girls preferred dolls, whereas boys preferred trucks. Another result that suggests, but does not prove, that hormones are involved in toy preferences is the observation that girls diagnosed with congenital adrenal hyperplasia (CAH), whose adrenal glands produce varying amounts of androgens early in life, played with masculine toys more often than girls without CAH. Further, a dose-response relationship between the extent of the disorder (i.e., degree of fetal androgen exposure) and degree of masculinization of play behavior was observed. Are the sex differences in toy preferences or play activity, for example, the inevitable consequences of the differential endocrine environments of boys and girls, or are these differences imposed by cultural practices and beliefs? Are these differences the result of receiving gender-specific toys from an early age, or are these differences some combination of endocrine and cultural factors? Again, these are difficult questions to unravel in people.

Even when behavioral sex differences appear early in development, there seems to be some question regarding the influences of societal expectations. One example is the pattern of human play behavior during which males are more physical; this pattern is seen in a number of other species including nonhuman primates, rats, and dogs. Is the difference in the frequency of rough-and-tumble play between boys and girls due to biological factors associated with being male or female, or is it due to cultural expectations and learning? If there is a combination of biological and cultural influences mediating the frequency of rough-and-tumble play, then what proportion of the variation between the sexes is due to biological factors and what proportion is due to social influences? Importantly, is it appropriate to talk about “normal” sex differences when these traits virtually always arrange themselves along a continuum rather than in discrete categories?

Sex differences are common in humans and in nonhuman animals. Because males and females differ in the ratio of

androgenic and estrogenic steroid hormone concentrations, behavioral endocrinologists have been particularly interested in the extent to which behavioral sex differences are mediated by hormones. The process of becoming female or male is called **sexual differentiation**. The primary step in sexual differentiation occurs at fertilization. In mammals, the ovum (which always contains an X chromosome) can be fertilized by a sperm bearing either a Y or an X chromosome; this process is called **sex determination**. The **chromosomal sex** of homogametic mammals (XX) is female; the chromosomal sex of heterogametic mammals (XY) is male. Chromosomal sex determines **gonadal sex**. Virtually all subsequent sexual differentiation is typically the result of differential exposure to gonadal steroid hormones. Thus, gonadal sex determines hormonal sex, which regulates morphological sex. Morphological differences in the central nervous system, as well as in some effector organs, such as muscles, lead to behavioral sex differences. The process of sexual differentiation is complicated, and the potential for errors is present. Perinatal exposure to androgens is the most common cause of anomalous sexual differentiation among females. The source of androgen may be internal (e.g., secreted by the adrenal glands) or external (e.g., exposure to environmental estrogens). Turner syndrome results when the second X chromosome is missing or damaged; these individuals possess dysgenetic ovaries and are not exposed to steroid hormones until puberty. Interestingly, women with Turner syndrome often have impaired spatial memory.

Female mammals are considered the “neutral” sex; additional physiological steps are required for male differentiation, and more steps bring more possibilities for errors in differentiation. Some examples of male anomalous sexual differentiation include **5 α -reductase** deficiency (in which XY individuals are born with ambiguous genitalia because of a lack of dihydrotestosterone and are reared as

females, but masculinization occurs during puberty) and androgen insensitivity syndrome or TFM (in which XY individuals lack receptors for androgens and develop as females). By studying individuals who do not neatly fall into the dichotic boxes of female or male and for whom the process of sexual differentiation is atypical, behavioral endocrinologists glean hints about the process of typical sexual differentiation.

We may ultimately want to know how hormones mediate sex differences in the human brain and behavior (to the extent to which these differences occur). To understand the mechanisms underlying sex differences in the brain and behavior, we return to the birdsong example. Birds provide the best evidence that behavioral sex differences are the result of hormonally induced structural changes in the brain (**Goodson, Saldanha, Hahn, & Soma, 2005**). In contrast to mammals, in which structural differences in neural tissues have not been directly linked to behavior, structural differences in avian brains have been directly linked to a sexually behavior: birdsong.

Several brain regions in songbirds display significant sex differences in size. Two major brain circuit pathways, (1) the song production motor pathway and (2) the auditory transmission pathway, have been implicated in the learning and production of birdsong. Some parts of the song production pathway of male zebra finches are 3 to 6 times larger than those of female conspecifics. The larger size of these brain areas reflects that neurons in these nuclei are larger, more numerous, and farther apart. Although castration of adult male birds reduces singing, it does not reduce the size of the brain nuclei controlling song production. Similarly, androgen treatment of adult female zebra finches does not induce changes either in singing or in the size of the song control regions. Thus, activational effects of steroid hormones do not account for the sex differences in singing behavior or brain nucleus size in zebra finches. The sex differences in these

structures are organized or programmed in the egg by estradiol (masculinizes) or the lack of steroids (feminizes).

Taken together, estrogens appear to be necessary to activate the neural machinery underlying the song system in birds. The testes of birds primarily produce androgens, which enter the circulation. The androgens enter neurons containing **aromatase**, which converts them to estrogens. Indeed, the brain is the primary source of estrogens, which activate masculine behaviors in many bird species.

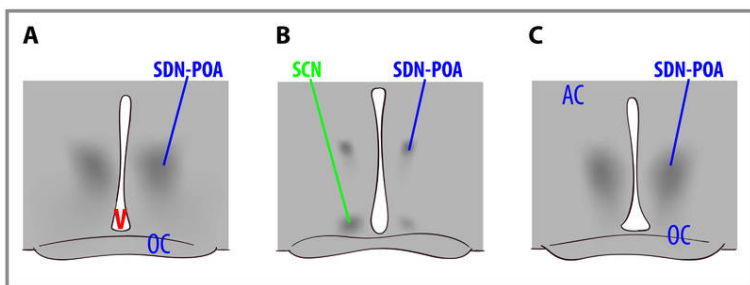


Figure 2: The sexually dimorphic nuclei of the preoptic area (SDN-POA) Gonadal steroid hormones have organizing effects upon brain and behavior. The organizing effects of steroid hormones are relatively constrained to the early stages of development. Exposure to testosterone (which is converted to estradiol) or estradiol causes masculinization of the brain. These are cross-sections through the brains of rats that show a male (left), a female (center), and a female treated with testosterone as a newborn (right). Note that the SDN-POA (the dark cell bodies) of the male are substantially larger than those of the untreated female but are equal in size to those of the testosterone-treated female. The extent that these sex differences in brain structure account for sex differences in behavior remain unspecified in mammals. OC = optic chiasm; SCN = suprachiasmatic nucleus; V = third ventricle

Sex differences in human brain size have been reported for years. More recently, sex differences in specific brain structures have been discovered (Figure 2). Sex differences in a number of cognitive functions have also been reported. Females are generally more sensitive to auditory information, whereas

males are more sensitive to visual information. Females are also typically more sensitive than males to taste and olfactory input. Women display less lateralization of cognitive functions than men. On average, females generally excel in verbal, perceptual, and fine motor skills, whereas males outperform females on quantitative and visuospatial tasks, including map reading and direction finding. Although reliable sex differences can be documented, these differences in ability are slight. It is important to note that there is more variation *within* each sex than *between* the sexes for most cognitive abilities (Figure 3).

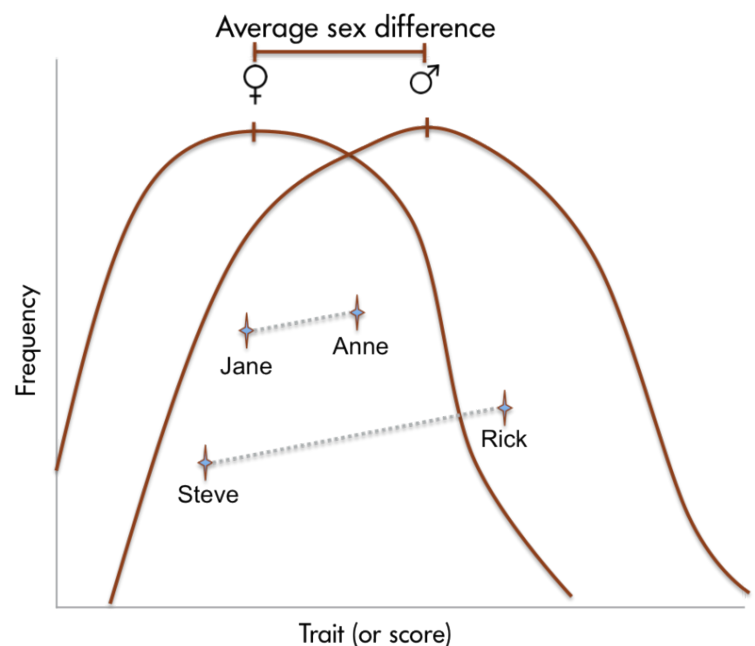


Figure 3: The average sex differences in human performance often reflect significant overlap between the sexes. There are often greater differences in performance between individuals of the same sex (for example, between Steve and Rick in the figure) than between individuals of the opposite sex (for example, between Steve and Jane in the figure).

Aggressive Behaviors

The possibility for **aggressive behavior** exists whenever the interests of two or more individuals are in conflict (Nelson, 2006). Conflicts are most likely to arise over limited resources such as territories, food, and mates. A social interaction decides which animal gains access to the contested resource. In many cases, a submissive posture or gesture on the part of one animal avoids the necessity of actual combat over a resource. Animals may also participate in threat displays or ritualized combat in which dominance is determined but no physical damage is inflicted.

There is overwhelming circumstantial evidence that androgenic steroid hormones mediate aggressive behavior across many species. First, seasonal variations in blood plasma concentrations of testosterone and seasonal variations in aggression coincide. For instance, the incidence of aggressive behavior peaks for male deer in autumn, when they are secreting high levels of testosterone. Second, aggressive behaviors increase at the time of puberty, when the testes become active and blood concentrations of androgens rise. Juvenile deer do not participate in the fighting during the mating season. Third, in any given species, males are generally more aggressive than females. This is certainly true of deer; relative to stags, female deer rarely display aggressive behavior, and their rare aggressive acts are qualitatively different from the aggressive behavior of aggressive males. Finally, castration typically reduces aggression in males, and testosterone replacement therapy restores aggression to pre-castration levels. There are some interesting exceptions to these general observations that are outside the scope of this module.

As mentioned, males are generally more aggressive than females. Certainly, human males are much more aggressive than females. Many more men than women are convicted of violent crimes in North America. The sex differences in human

aggressiveness appear very early. At every age throughout the school years, many more boys than girls initiate physical assaults. Almost everyone will acknowledge the existence of this sex difference, but assigning a cause to behavioral sex differences in humans always elicits much debate. It is possible that boys are more aggressive than girls because androgens promote aggressive behavior and boys have higher blood concentrations of androgens than girls. It is possible that boys and girls differ in their aggressiveness because the brains of boys are exposed to androgens prenatally and the “wiring” of their brains is thus organized in a way that facilitates the expression of aggression. It is also possible that boys are encouraged and girls are discouraged by family, peers, or others from acting in an aggressive manner. These three hypotheses are not mutually exclusive, but it is extremely difficult to discriminate among them to account for sex differences in human aggressiveness.

What kinds of studies would be necessary to assess these hypotheses? It is usually difficult to separate out the influences of environment and physiology on the development of behavior in humans. For example, boys and girls differ in their rough-and-tumble play at a very young age, which suggests an early physiological influence on aggression. However, parents interact with their male and female offspring differently; they usually play more roughly with male infants than with females, which



Researchers have electrically stimulated particular regions in people's brains, and these individuals have burst into aggressive, violent behavior, helping demonstrate that such responses are hardwired into us. [Image: Riccardo Cuppini, <https://goo.gl/b6bHU2>, CC BY-NC-ND 2.0, <https://goo.gl/bhtmlY>]

suggests that the sex difference in aggressiveness is partially learned. This difference in parental interaction style is evident by the first week of life. Because of these complexities in the factors influencing human behavior, the study of hormonal effects on sex-differentiated behavior has been pursued in nonhuman animals, for which environmental influences can be held relatively constant. Animal models for which sexual differentiation occurs postnatally are often used so that this process can be easily manipulated experimentally.

Again, with the appropriate animal model, we can address the questions posed above: Is the sex difference in aggression due to higher adult blood concentrations of androgens in males than in females, or are males more aggressive than females because their brains are organized differently by perinatal hormones? Are males usually more aggressive than females because of an interaction of early and current blood

androgen concentrations? If male mice are castrated prior to their sixth day of life, then treated with testosterone propionate in adulthood, they show low levels of aggression. Similarly, females ovariectomized prior to their sixth day but given androgens in adulthood do not express male-like levels of aggression. Treatment of perinatally gonadectomized males or females with testosterone prior to their sixth day life and also in adulthood results in a level of aggression similar to that observed in typical male mice. Thus, in mice, the proclivity for males to act more aggressively than females is organized perinatally by androgens but also requires the presence of androgens after puberty in order to be fully expressed. In other words, aggression in male mice is both organized and activated by androgens. Testosterone exposure in adulthood without prior organization of the brain by steroid hormones does not evoke typical male levels of aggression. The hormonal control of aggressive behavior in house mice is thus similar to the hormonal mediation of heterosexual male mating behavior in other rodent species. Aggressive behavior is both organized and activated by androgens in many species, including rats, hamsters, voles, dogs, and possibly some primate species.

Parental Behaviors

Parental behavior can be considered to be any behavior that contributes directly to the survival of fertilized eggs or offspring that have left the body of the female. There are many patterns of mammalian parental care. The developmental status of the newborn is an important factor driving the type and quality of parental care in a species. Maternal care is much more common than **paternal** care. The vast majority of research on the hormonal correlates of mammalian parental behavior has been conducted on rats. Rats bear altricial young, and mothers perform a cluster of stereotyped maternal behaviors, including

nest building, crouching over the pups to allow nursing and to provide warmth, pup retrieval, and increased aggression directed at intruders. If you expose nonpregnant female rats (or males) to pups, their most common reaction is to huddle far away from them. Rats avoid new things (neophobia). However, if you expose adult rats to pups every day, they soon begin to behave maternally. This process is called concaveation or sensitization and it appears to serve to reduce the adult rats' fear of pups.

Of course a new mother needs to act maternal as soon as her offspring arrive—not in a week. The onset of maternal behavior in rats is mediated by hormones. Several methods of study, such as hormone removal and replacement therapy, have been used to determine the hormonal correlates of rat maternal behavior. A fast decline of blood concentrations of **progesterone** in late pregnancy after sustained high concentrations of this hormone, in combination with high concentrations of estradiol and probably prolactin and oxytocin, induces female rats to behave maternally almost immediately in the presence of pups. This pattern of hormones at parturition overrides the usual fear response of adult rats toward pups, and it permits the onset of maternal behavior. Thus, the so-called maternal “instinct” requires hormones to increase the approach tendency and lower the avoidance tendency. Laboratory strains of mice and rats are usually docile, but mothers can be quite aggressive toward animals that venture too close to their litter. Progesterone appears to be the primary hormone that induces this maternal aggression in rodents, but species differences exist. The role of maternal aggression in women's behavior has not been adequately described or tested.



Although cortisol may not directly increase maternal behaviors, the next time your mom gives you a hug you know one hormone to thank. [Image: Maria Grazia Montagnari, <https://goo.gl/LY1Tq0>, CC BY 2.0, <https://goo.gl/BRvSA7>]

A series of elegant experiments by Alison Fleming and her collaborators studied the endocrine correlates of the behavior of human mothers as well as the endocrine correlates of maternal attitudes as expressed in self-report questionnaires. Responses such as patting, cuddling, or kissing the baby were called affectionate behaviors; talking, singing, or cooing to the baby were considered vocal behaviors.

Both affectionate and vocal behaviors were considered approach behaviors. Basic caregiving activities, such as changing diapers and burping the infants, were also recorded. In these studies, no relationship between hormone concentrations and maternal responsiveness, as measured by attitude questionnaires, was found. For example, most women showed an increasing positive self-image during early pregnancy that dipped during the second half of pregnancy, but recovered after parturition. A related dip in feelings of maternal engagement occurred during late pregnancy, but rebounded substantially after birth in most women. However, when behavior, rather than questionnaire responses, was compared with hormone concentrations, a different story emerged. Blood plasma concentrations of cortisol were positively associated with approach behaviors. In other words, women who had high concentrations of blood cortisol, in samples obtained immediately before or after nursing, engaged in more physically affectionate behaviors and talked more often to their

babies than mothers with low cortisol concentrations. Additional analyses from this study revealed that the correlation was even greater for mothers that had reported positive maternal regard (feelings and attitudes) during gestation. Indeed, nearly half of the variation in maternal behavior among women could be accounted for by cortisol concentrations and positive maternal attitudes during pregnancy.

Presumably, cortisol does not induce maternal behaviors directly, but it may act indirectly on the quality of maternal care by evoking an increase in the mother's general level of arousal, thus increasing her responsiveness to infant-generated cues. New mothers with high cortisol concentrations were also more attracted to their infant's odors, were superior in identifying their infants, and generally found cues from infants highly appealing (**Fleming, Steiner, & Corter, 1997**).

The medial preoptic area is critical for the expression of rat maternal behavior. The amygdala appears to tonically inhibit the expression of maternal behavior. Adult rats are fearful of pups, a response that is apparently mediated by chemosensory information. Lesions of the amygdala or afferent sensory pathways from the vomeronasal organ to the amygdala disinhibit the expression of maternal behavior. Hormones or sensitization likely act to disinhibit the amygdala, thus permitting the occurrence of maternal behavior. Although correlations have been established, direct evidence of brain structural changes in human mothers remains unspecified (**Fleming & Gonzalez, 2009**).

Considered together, there are many examples of hormones influencing behavior and of behavior feeding back to influence hormone secretion. More and more examples of hormone-behavior interactions are discovered, including hormones in the mediation of food and fluid intake, social interactions, salt balance, learning and memory, stress coping, as well as psychopathology including depression, anxiety

disorders, eating disorders, postpartum depression, and seasonal depression. Additional research should reveal how these hormone–behavior interactions are mediated.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

5 α -reductase

An enzyme required to convert testosterone to 5 α -dihydrotestosterone.

Aggression

A form of social interaction that includes threat, attack, and fighting.

Aromatase

An enzyme that converts androgens into estrogens.

Chromosomal sex

The sex of an individual as determined by the sex chromosomes (typically XX or XY) received at the time of fertilization.

Defeminization

The removal of the potential for female traits.

Demasculinization

The removal of the potential for male traits.

Dihydrotestosterone (DHT)

A primary androgen that is an androgenic steroid product of testosterone and binds strongly to androgen receptors.

Endocrine gland

A ductless gland from which hormones are released into

the blood system in response to specific biological signals.

Estrogen

Any of the C18 class of steroid hormones, so named because of the estrus-generating properties in females. Biologically important estrogens include estradiol and estriol.

Feminization

The induction of female traits.

Gonadal sex

The sex of an individual as determined by the possession of either ovaries or testes. Females have ovaries, whereas males have testes.

Hormone

An organic chemical messenger released from endocrine cells that travels through the blood to interact with target cells at some distance to cause a biological response.

Masculinization

The induction of male traits.

Maternal behavior

Parental behavior performed by the mother or other female.

Neurotransmitter

A chemical messenger that travels between neurons to provide communication. Some neurotransmitters, such as norepinephrine, can leak into the blood system and act as hormones.

Oxytocin

A peptide hormone secreted by the pituitary gland to trigger lactation, as well as social bonding.

Parental behavior

Behaviors performed in relation to one's offspring that contributes directly to the survival of those offspring

Paternal behavior

Parental behavior performed by the father or other male.

Progesterone

A primary progestin that is involved in pregnancy and mating behaviors.

Progestin

A class of C21 steroid hormones named for their progestational (pregnancy-supporting) effects. Progesterone is a common progestin.

Prohormone

A molecule that can act as a hormone itself or be converted into another hormone with different properties. For example, testosterone can serve as a hormone or as a prohormone for either dihydrotestosterone or estradiol.

Prolactin

A protein hormone that is highly conserved throughout the animal kingdom. It has many biological functions associated with reproduction and synergistic actions with steroid hormones.

Receptor

A chemical structure on the cell surface or inside of a cell that has an affinity for a specific chemical configuration of a hormone, neurotransmitter, or other compound.

Sex determination

The point at which an individual begins to develop as either a male or a female. In animals that have sex chromosomes, this occurs at fertilization. Females are XX and males are XY. All eggs bear X chromosomes, whereas

sperm can either bear X or Y chromosomes. Thus, it is the males that determine the sex of the offspring.

Sex differentiation

The process by which individuals develop the characteristics associated with being male or female. Differential exposure to gonadal steroids during early development causes sexual differentiation of several structures including the brain.

Target cell

A cell that has receptors for a specific chemical messenger (hormone or neurotransmitter).

Testosterone

The primary androgen secreted by the testes of most vertebrate animals, including men.

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16.

Psychopharmacology

Original chapter by Susan Barron adapted
by the Queen's University Psychology
Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

Psychopharmacology is the study of how drugs affect behavior. If a drug changes your perception, or the way you feel or think, the drug exerts effects on your brain and nervous system. We call drugs that change the way you think or feel psychoactive or psychotropic drugs, and almost everyone has used a psychoactive drug at some point (yes, caffeine counts). Understanding some of the basics about psychopharmacology can help us better understand a wide range of things that interest psychologists and others. For example, the pharmacological treatment of certain neurodegenerative diseases such as Parkinson's disease tells us something about the disease itself. The pharmacological treatments used to treat psychiatric conditions such as schizophrenia or depression have undergone amazing development since the 1950s, and the drugs used to treat these disorders tell us something about what is happening in the brain of individuals with these conditions. Finally, understanding something about

the actions of drugs of abuse and their routes of administration can help us understand why some psychoactive drugs are so addictive. In this module, we will provide an overview of some of these topics as well as discuss some current controversial areas in the field of psychopharmacology.

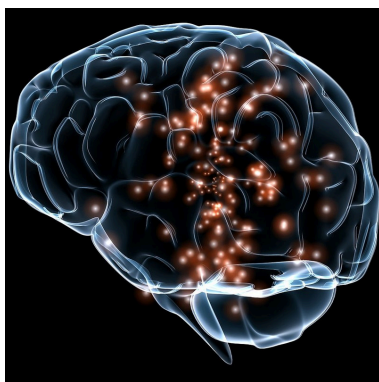
Learning Objectives

- How do the majority of psychoactive drugs work in the brain?
- How does the route of administration affect how rewarding a drug might be?
- Why is grapefruit dangerous to consume with many psychotropic medications?
- Why might individualized drug doses based on genetic screening be helpful for treating conditions like depression?
- Why is there controversy regarding pharmacotherapy for children, adolescents, and the elderly?

Introduction

Psychopharmacology, the study of how drugs affect the brain and behavior, is a relatively new science, although people have probably been taking drugs to change how they feel from early in human history (consider the of eating fermented fruit, ancient beer recipes, chewing on the leaves of the cocaine plant for stimulant properties as just some examples). The word *psychopharmacology* itself tells us that this is a field that bridges our understanding of behavior (and brain) and pharmacology, and the range of topics included within this field is extremely broad.

Virtually any drug that changes the way you feel does this by altering how neurons communicate with each other. Neurons (more than 100 billion in your nervous system) communicate with each other by releasing a chemical (**neurotransmitter**) across a tiny space between two neurons (the **synapse**). When the neurotransmitter crosses the synapse, it binds to a postsynaptic receptor (protein) on the receiving



Drugs that alter our feelings and behavior do so by affecting the communication between neurons in the brain. [Image: <https://goo.gl/oQCafL>, CCO Public Domain, <https://goo.gl/m25gce>]

neuron and the message may then be transmitted onward. Obviously, neurotransmission is far more complicated than this – links at the end of this module can provide some useful background if you want more detail – but the first step is understanding that virtually all **psychoactive drugs** interfere with or alter how neurons communicate with each other.

There are many neurotransmitters. Some of the most important in terms of psychopharmacological treatment and drugs of abuse are outlined in Table 1. The neurons that release these neurotransmitters, for the most part, are localized within specific circuits of the brain that mediate these behaviors. Psychoactive drugs can either increase activity at the synapse (these are called **agonists**) or reduce activity at the synapse (**antagonists**). Different drugs do this by different mechanisms, and some examples of agonists and antagonists are presented in Table 2. For each example, the drug's trade name, which is the name of the drug provided by the drug company, and generic name (in parentheses) are provided.

Neurotransmitter	Abbreviation	Behaviors or Diseases Related to These Neurotransmitter
Acetylcholine	ACh	Learning and memory; Alzheimer's disease; muscle movement in the peripheral nervous system
Dopamine	DA	Reward circuits; Motor circuits involved in Parkinson's disease; Schizophrenia
Norepinephrine	NE	Arousal; Depression
Serotonin	5HT	Depression; Aggression; Schizophrenia
Glutamate	GLU	Learning; Major excitatory neurotransmitter in the brain
GABA	GABA	Anxiety disorders; Epilepsy; Major inhibitory neurotransmitter in the brain
Endogenous Opioids	Endorphins, Enkephalins	Pain; Analgesia; Reward

Table 1

A very useful link at the end of this module shows the various steps involved in neurotransmission and some ways drugs can alter this.

Table 2 provides examples of drugs and their primary mechanism of action, but it is very important to realize that drugs also have effects on other neurotransmitters. This contributes to the kinds of side effects that are observed when someone takes a particular drug. The reality is that no drugs currently available work only exactly where we would like in the brain or only on a specific neurotransmitter. In many cases, individuals are sometimes prescribed one **psychotropic drug** but then may also have to take additional drugs to reduce the side effects caused by the initial drug. Sometimes individuals stop taking medication because the side effects can be so profound.

Drug	Mechanism	Use	Agonist/Antagonist
L-dopa	Increase synthesis of DA	Parkinson's disease	Agonist for DA
Adderall (mixed salts amphetamine)	Increase release of DA, NE	ADHD	Agonist for DA, NE
Ritalin (methylphenidate)	Blocks removal of DA, NE, and lesser (5HT) from synapse	ADHD	Agonist for DA, NE mostly
Aricept (donepezil)	Blocks removal of ACh from synapse	Alzheimer's disease	Agonist for ACh
Prozac (fluoxetine)	Blocks removal of 5HT from synapse	Depression, obsessive compulsive disorder	Agonist 5HT
Seroquel (quetiapine)	Blocks DA and 5HT receptors	Schizophrenia, bipolar disorder	Antagonist for DA, 5HT
Revia (naltrexone)	Blocks opioid post-synaptic receptors	Alcoholism, opioid addiction	Antagonist (for opioids)

Table 2

Pharmacokinetics: What Is It – Why Is It Important?

While this section may sound more like pharmacology, it is important to realize how important pharmacokinetics can be when considering psychoactive drugs. **Pharmacokinetics** refers to how the body handles a drug that we take. As mentioned earlier, psychoactive drugs exert their effects on behavior by altering neuronal communication in the brain, and the majority of drugs reach the brain by traveling in the blood. The acronym ADME is often used with A standing for absorption (how the drug gets into the blood), Distribution (how the drug gets to the organ of interest – in this module, that is the brain), Metabolism (how the drug is broken down so it no longer exerts its psychoactive effects), and Excretion (how the drug leaves the body). We will talk about a couple of these to show their importance for considering psychoactive drugs.

Drug Administration



A drug delivered by IV reaches the brain more quickly than if the drug is taken orally. While rapid delivery has advantages, there are also risks involved with IV administration. [Image: Calleamanecer, <https://goo.gl/OX6Yj5>, CC BY-SA 3.0, <https://goo.gl/eLCn2O>]

There are many ways to take drugs, and these routes of drug administration can have a significant impact on how quickly that drug reaches brain. The most common route of administration is oral administration, which is relatively slow and – perhaps surprisingly – often the most variable and complex route of administration. Drugs enter the stomach and then get absorbed by the blood supply and capillaries that line the small intestine. The rate of absorption can be

affected by a variety of factors including the quantity and the type of food in the stomach (e.g., fats vs. proteins). This is why the medicine label for some drugs (like antibiotics) may specifically state foods that you should or should NOT consume within an hour of taking the drug because they can affect the rate of absorption. Two of the most rapid routes of administration include inhalation (i.e., smoking or gaseous anesthesia) and intravenous (IV) in which the drug is injected directly into the vein and hence the blood supply. Both of these routes of administration can get the drug to brain in less than 10 seconds. IV administration also has the distinction of being the most dangerous because if there is an adverse drug reaction, there is very little time to administer any antidote, as in the case of an IV heroin overdose.

Why might how quickly a drug gets to the brain be

important? If a drug activates the reward circuits in the brain AND it reaches the brain very quickly, the drug has a high risk for abuse and addiction. Psychostimulants like amphetamine or cocaine are examples of drugs that have high risk for abuse because they are agonists at DA neurons involved in reward AND because these drugs exist in forms that can be either smoked or injected intravenously. Some argue that cigarette smoking is one of the hardest addictions to quit, and although part of the reason for this may be that smoking gets the nicotine into the brain very quickly (and indirectly acts on DA neurons), it is a more complicated story. For drugs that reach the brain very quickly, not only is the drug very addictive, but so are the cues associated with the drug (see **Rohsenow, Niaura, Childress, Abrams, & Monti, 1990**). For a crack user, this could be the pipe that they use to smoke the drug. For a cigarette smoker, however, it could be something as normal as finishing dinner or waking up in the morning (if that is when the smoker usually has a cigarette). For both the crack user and the cigarette smoker, the cues associated with the drug may actually cause craving that is alleviated by (you guessed it) – lighting a cigarette or using crack (i.e., relapse). This is one of the reasons individuals that enroll in drug treatment programs, especially out-of-town programs, are at significant risk of relapse if they later find themselves in proximity to old haunts, friends, etc. But this is much *more* difficult for a cigarette smoker. How can someone avoid eating? Or avoid waking up in the morning, etc. These examples help you begin to understand how important the route of administration can be for psychoactive drugs.

Drug Metabolism

Metabolism involves the breakdown of psychoactive drugs, and this occurs primarily in the liver. The liver produces

enzymes (proteins that speed up a chemical reaction), and these enzymes help catalyze a chemical reaction that breaks down psychoactive drugs. Enzymes exist in “families,” and many psychoactive drugs are broken down by the same family of enzymes, the cytochrome P450 superfamily. There is not a unique enzyme for each drug; rather, certain enzymes can break down a wide variety of drugs. Tolerance to the effects of many drugs can occur with repeated exposure; that is, the drug produces less of an effect over time, so more of the drug is needed to get the same effect. This is particularly true for sedative drugs like alcohol or opiate-based painkillers. *Metabolic tolerance* is one kind of tolerance and it takes place in the liver. Some drugs (like alcohol) cause **enzyme induction** – an increase in the enzymes produced by the liver. For example, chronic drinking results in alcohol being broken down more quickly, so the alcoholic needs to drink more to get the same effect – of course, until so much alcohol is consumed that it damages the liver (alcohol can cause fatty liver or cirrhosis).

Recent Issues Related to Psychotropic Drugs and Metabolism

Grapefruit Juice and Metabolism



Grapefruit can interfere with enzymes in the liver that help the body to process certain drugs.
[Image: CC0 Public Domain, <https://goo.gl/m25gce>]

Certain types of food in the stomach can alter the rate of drug absorption, and other foods can also alter the rate of drug metabolism. The most well known is grapefruit juice. Grapefruit juice suppresses cytochrome P450 enzymes in the liver, and these liver enzymes normally break down a large variety of drugs (including some of the psychotropic drugs). If the enzymes are suppressed, drug levels can

build up to potentially toxic levels. In this case, the effects can persist for extended periods of time after the consumption of grapefruit juice. As of 2013, there are at least 85 drugs shown to adversely interact with grapefruit juice (**Bailey, Dresser, & Arnold, 2013**). Some psychotropic drugs that are likely to interact with grapefruit juice include carbamazepine (Tegretol), prescribed for bipolar disorder; diazepam (Valium), used to treat anxiety, alcohol withdrawal, and muscle spasms; and fluvoxamine (Luvox), used to treat obsessive compulsive disorder and depression. A link at the end of this module gives the latest list of drugs reported to have this unusual interaction.

Individualized Therapy, Metabolic Differences, and Potential Prescribing Approaches for the Future

Mental illnesses contribute to more disability in western countries than all other illnesses including cancer and heart disease. Depression alone is predicted to be the second largest contributor to disease burden by 2020 (**World Health Organization, 2004**). The numbers of people affected by mental health issues are pretty astonishing, with estimates that 25% of adults experience a mental health issue in any given year, and this affects not only the individual but their friends and family. One in 17 adults experiences a serious mental illness (**Kessler, Chiu, Demler, & Walters, 2005**). Newer antidepressants are probably the most frequently prescribed drugs for treating mental health issues, although there is no “magic bullet” for treating depression or other conditions. Pharmacotherapy with psychological therapy may be the most beneficial treatment approach for many psychiatric conditions, but there are still many unanswered questions. For example, why does one antidepressant help one individual yet have no effect for another? Antidepressants can take 4 to 6 weeks to start improving depressive symptoms, and we don't really understand why. Many people do not respond to the first antidepressant prescribed and may have to try different drugs before finding something that works for them. Other people just do not improve with antidepressants (**Ioannidis, 2008**). As we better understand why individuals differ, the easier and more rapidly we will be able to help people in distress.

One area that has received interest recently has to do with an individualized treatment approach. We now know that there are genetic differences in some of the cytochrome P450 enzymes and their ability to break down drugs. The general population falls into the following 4 categories: 1) *ultra-*

extensive metabolizers break down certain drugs (like some of the current antidepressants) very, very quickly, 2) *extensive metabolizers* are also able to break down drugs fairly quickly, 3) *intermediate metabolizers* break down drugs more slowly than either of the two above groups, and finally 4) *poor metabolizers* break down drugs much more slowly than all of the other groups. Now consider someone receiving a prescription for an antidepressant – what would the consequences be if they were either an ultra-extensive metabolizer or a poor metabolizer? The ultra-extensive metabolizer would be given antidepressants and told it will probably take 4 to 6 weeks to begin working (this is true), but they metabolize the medication so quickly that it will never be effective for them. In contrast, the poor metabolizer given the same daily dose of the same antidepressant may build up such high levels in their blood (because they are not breaking the drug down), that they will have a wide range of side effects and feel really badly – also not a positive outcome. What if – instead – prior to prescribing an antidepressant, the doctor could take a blood sample and determine which type of metabolizer a patient actually was? They could then make a much more informed decision about the best dose to prescribe. There are new genetic tests now available to better individualize treatment in just this way. A blood sample can determine (at least for some drugs) which category an individual fits into, but we need data to determine if this actually is effective for treating depression or other mental illnesses (Zhou, 2009). Currently, this genetic test is expensive and not many health insurance plans cover this screen, but this may be an important component in the future of psychopharmacology.

Other Controversial Issues

Juveniles and Psychopharmacology

A recent Centers for Disease Control (CDC) report has suggested that as many as 1 in 5 children between the ages of 5 and 17 may have some type of mental disorder (e.g., ADHD, autism, anxiety, depression) (CDC, 2013). The incidence of bipolar disorder in children and adolescents has also increased 40 times in the past decade (Moreno, Laje, Blanco, Jiang, Schmidt, & Olfson, 2007), and it is now estimated that 1 in 88 children have been diagnosed with an autism spectrum disorder (CDC, 2011). Why has there been such an increase in these numbers? There is no single answer to this important question. Some believe that greater public awareness has contributed to increased teacher and parent referrals. Others argue that the increase stems from changes in criterion currently used for diagnosing. Still others suggest environmental factors, either prenatally or postnatally, have contributed to this upsurge.

We do not have an answer, but the question does bring up an additional controversy related to how we should treat this population of children and adolescents. Many psychotropic drugs used for treating psychiatric disorders have been tested in adults, but few have been tested for safety or efficacy with children or adolescents. The most well-established psychotropics prescribed for children and adolescents are



There are concerns about both the safety and efficacy of drugs like Prozac for children and teens.

[Image: zaza_bj, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

the psychostimulant drugs used for treating attention deficit hyperactivity disorder (ADHD), and there are clinical data on how effective these drugs are. However, we know far less about the safety and efficacy in young populations of the drugs typically prescribed for treating anxiety, depression, or other psychiatric disorders. The young brain continues to mature until probably well after age 20, so some scientists are concerned that drugs that alter neuronal activity in the developing brain could have significant consequences. There is an obvious need for clinical trials in children and adolescents to test the safety and effectiveness of many of these drugs, which also brings up a variety of ethical questions about who decides what children and adolescents will participate in these clinical trials, who can give consent, who receives reimbursements, etc.

The Elderly and Psychopharmacology

Another population that has not typically been included in clinical trials to determine the safety or effectiveness of

psychotropic drugs is the elderly. Currently, there is very little high-quality evidence to guide prescribing for older people – clinical trials often exclude people with multiple comorbidities (other diseases, conditions, etc.), which are typical for elderly populations (see **Hilmer and Gnjidict, 2008; Pollock, Forsyth, & Bies, 2008**). This is a serious issue because the elderly consume a disproportionate number of the prescription meds prescribed. The term **polypharmacy** refers to the use of multiple drugs, which is very common in elderly populations in the United States. As our population ages, some estimate that the proportion of people 65 or older will reach 20% of the U.S. population by 2030, with this group consuming 40% of the prescribed medications. As shown in Table 3 (from **Schwartz and Abernethy, 2008**), it is quite clear why the typical clinical trial that looks at the safety and effectiveness of psychotropic drugs can be problematic if we try to interpret these results for an elderly population.

Clinical Trial Subjects	Aged Patients Who Receive Drug Therapies
One drug	Drug of interest and medications
Single doses	Chronic administration
No disease	Multiple diseases
No alcohol, tobacco, OTC* drugs, nutraceuticals	OTC* drugs, nutraceuticals, alcohol, tobacco, and other
20-40 years (vs 60-75 years)	65-100+ years
Caucasians	Caucasians and minorities
Selection bias	All comers/socioeconomic basis

*OTC = Over the counter

Table 3. Characteristics of clinical trial subjects vs. actual patients. (Reprinted by permission from Schwartz & Abernethy, 2008.)

Metabolism of drugs is often slowed considerably for elderly populations, so less drug can produce the same effect (or all too often, too much drug can result in a variety of side effects). One of the greatest risk factors for elderly populations is falling (and breaking bones), which can happen if the elderly person gets dizzy from too much of a drug. There is also evidence that psychotropic medications can reduce bone density (thus worsening the consequences if someone falls) (**Brown & Mezuk, 2012**). Although we are gaining an awareness about some of the issues facing pharmacotherapy in older populations, this is a very complex area with many medical and ethical questions.

This module provided an introduction of some of the important areas in the field of psychopharmacology. It should be apparent that this module just touched on a number of topics included in this field. It should also be apparent that understanding more about psychopharmacology is important to anyone interested in understanding behavior and that our understanding of issues in this field has important implications for society.

An Interactive Exploration

To explore psychopharmacology a bit further, we encourage you to check out this interactive from the Genetic Science Learning Center at the University of Utah. Click [HERE](#) to access.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as

practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Agonists

A drug that increases or enhances a neurotransmitter's effect.

Antagonist

A drug that blocks a neurotransmitter's effect.

Enzyme

A protein produced by a living organism that allows or helps a chemical reaction to occur.

Enzyme induction

Process through which a drug can enhance the production of an enzyme.

Metabolism

Breakdown of substances.

Neurotransmitter

A chemical substance produced by a neuron that is used for communication between neurons.

Pharmacokinetics

The action of a drug through the body, including absorption, distribution, metabolism, and excretion.

Polypharmacy

The use of many medications.

Psychoactive drugs

A drug that changes mood or the way someone feels.

Psychotropic drug

A drug that changes mood or emotion, usually used when talking about drugs prescribed for various mental conditions (depression, anxiety, schizophrenia, etc.).

Synapse

The tiny space separating neurons.

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PSYC 100 VI

NEUROBIOLOGY

17. The Nervous System

Original chapter by Aneeq Ahmad adapted by the Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

The mammalian nervous system is a complex biological organ, which enables many animals including humans to function in a coordinated fashion. The original design of this system is preserved across many animals through evolution; thus, adaptive physiological and behavioral functions are similar across many animal species. Comparative study of physiological functioning in the nervous systems of different animals lend insights to their behavior and their mental processing and make it easier for us to understand the human brain and behavior. In addition, studying the development of the nervous system in a growing human provides a wealth of information about the change in its form and behaviors that result from this change. The nervous system is divided into central and peripheral nervous systems, and the two heavily interact with one another. The peripheral nervous system controls volitional (somatic nervous system) and nonvolitional (autonomic nervous system) behaviors using cranial and spinal nerves. The central nervous system is divided into forebrain,

midbrain, and hindbrain, and each division performs a variety of tasks; for example, the cerebral cortex in the forebrain houses sensory, motor, and associative areas that gather sensory information, process information for perception and memory, and produce responses based on incoming and inherent information. To study the nervous system, a number of methods have evolved over time; these methods include examining brain lesions, microscopy, electrophysiology, electroencephalography, and many scanning technologies.

Learning Objectives

- Describe and understand the development of the nervous system.
- Learn and understand the two important parts of the nervous system.
- Explain the two systems in the peripheral nervous system and what you know about the different regions and areas of the central nervous system.
- Learn and describe different techniques of studying the nervous system. Understand which of these techniques are important for cognitive neuroscientists.
- Describe the reasons for studying different nervous systems in animals other than human beings. Explain what lessons we learn from the evolutionary history of this organ.

Evolution of the Nervous System

Many scientists and thinkers (**Cajal, 1937; Crick & Koch, 1990; Edelman, 2004**) believe that the human nervous system is the most complex machine known to man. Its complexity points to

one undeniable fact—that it has evolved slowly over time from simpler forms. Evolution of the nervous system is intriguing not because we can marvel at this complicated biological structure, but it is fascinating because it inherits a lineage of a long history of many less complex nervous systems (Figure 1), and it documents a record of adaptive behaviors observed in life forms other than humans. Thus, evolutionary study of the nervous system is important, and it is the first step in understanding its design, its workings, and its functional interface with the environment.

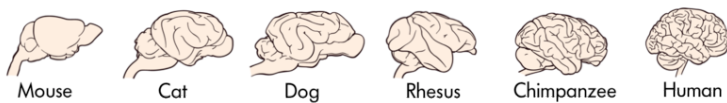


Figure 1 The brains of various animals

The brains of some animals, like apes, monkeys, and rodents, are structurally similar to humans (Figure 1), while others are not (e.g., invertebrates, single-celled organisms). Does anatomical similarity of these brains suggest that behaviors that emerge in these species are also similar? Indeed, many animals display behaviors that are similar to humans, e.g., apes use nonverbal communication signals with their hands and arms that resemble nonverbal forms of communication in humans (**Gardner & Gardner, 1969; Goodall, 1986; Knapp & Hall, 2009**). If we study very simple behaviors, like physiological responses made by individual neurons, then brain-based behaviors of invertebrates (**Kandel & Schwartz, 1982**) look very similar to humans, suggesting that from time immemorial such basic behaviors have been conserved in the brains of many simple animal forms and in fact are the foundation of more complex behaviors in animals that evolved later (**Bullock, 1984**).

Even at the micro-anatomical level, we note that individual

neurons differ in complexity across animal species. Human neurons exhibit more intricate complexity than other animals; for example, neuronal processes (dendrites) in humans have many more branch points, branches, and spines.

Complexity in the structure of the nervous system, both at the macro- and micro-levels, give rise to complex behaviors. We can observe similar movements of the limbs, as in nonverbal communication, in apes and humans, but the variety and intricacy of nonverbal behaviors using hands in humans surpasses apes. Deaf individuals who use American Sign Language (ASL) express themselves in English nonverbally; they use this language with such fine gradation that many accents of ASL exist (Walker, 1987). Complexity of behavior with increasing complexity of the nervous system, especially the cerebral cortex, can be observed in the genus *Homo* (Figure 2). If we compare sophistication of material culture in **Homo habilis** (2 million years ago; brain volume ~650 cm³) and **Homo sapiens** (300,000 years to now; brain volume ~1400 cm³), the evidence shows that *Homo habilis* used crude stone tools compared with modern tools used by *Homo sapiens* to erect cities, develop written languages, embark on space travel, and study her own self. All of this is due to increasing complexity of the nervous system.

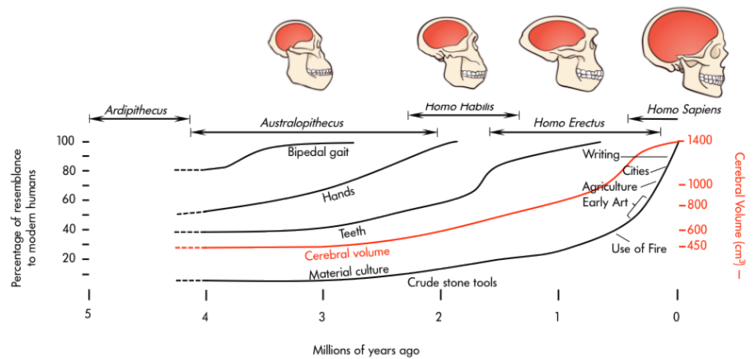


Figure 2 Changes in cerebral volume across evolution

What has led to the complexity of the brain and nervous system through evolution, to its behavioral and cognitive refinement? Darwin (1859, 1871) proposed two forces of natural and sexual selection as work engines behind this change. He prophesied, “psychology will be based on a new foundation, that of the necessary acquirement of each mental power and capacity by gradation” that is, psychology will be based on evolution (Rosenzweig, Breedlove, & Leiman, 2002).

Development of the Nervous System

Where the study of change in the nervous system over eons is immensely captivating, studying the change in a single brain during individual development is no less engaging. In many ways the ontogeny (development) of the nervous system in an individual mimics the evolutionary advancement of this structure observed across many animal species. During development, the nervous tissue emerges from the **ectoderm** (one of the three layers of the mammalian embryo) through the process of **neural induction**. This process causes the formation of the neural tube, which extends in a **rostrocaudal** (head-to-tail) plane. The tube, which is hollow, seams itself in the rostrocaudal direction. In some disease conditions, the neural tube does not close caudally and results in an abnormality called **spina bifida**. In this pathological condition, the lumbar and sacral segments of the spinal cord are disrupted.

As gestation progresses, the neural tube balloons up (cephalization) at the rostral end, and **forebrain**, midbrain, hindbrain, and the spinal cord can be visually delineated (day 40). About 50 days into gestation, six cephalic areas can be anatomically discerned (also see below for a more detailed description of these areas).

The progenitor cells (**neuroblasts**) that form the lining

(**neuroepithelium**) of the neural tube generate all the neurons and glial cells of the central nervous system. During early stages of this development, neuroblasts rapidly divide and specialize into many varieties of neurons and glial cells, but this proliferation of cells is not uniform along the neural tube—that is why we see the forebrain and hindbrain expand into larger cephalic tissues than the midbrain. The neuroepithelium also generates a group of specialized cells that migrate outside the neural tube to form the **neural crest**. This structure gives rise to sensory and autonomic neurons in the peripheral nervous system.

The Structure of the Nervous System

The mammalian nervous system is divided into central and peripheral nervous systems.

The Peripheral Nervous System

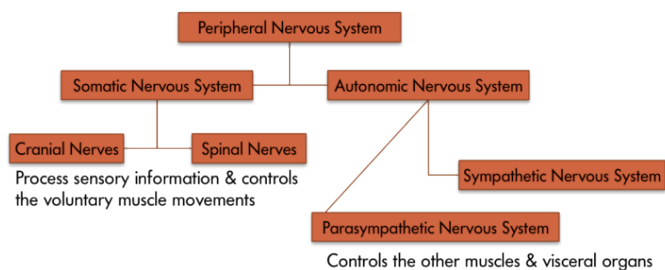


Figure 3 The various components of the peripheral nervous system

The peripheral nervous system is divided into somatic and **autonomic nervous systems** (Figure 3). Where the **somatic**

nervous system consists of cranial nerves (12 pairs) and spinal nerves (31 pairs) and is under the volitional control of the individual in maneuvering bodily muscles, the autonomic nervous system also running through these nerves lets the individual have little control over muscles and glands. Main divisions of the autonomic nervous system that control visceral structures are the sympathetic and **parasympathetic nervous systems**.

At an appropriate cue (say a fear-inducing object like a snake), the sympathetic division generally energizes many muscles (e.g., heart) and glands (e.g., adrenals), causing activity and release of hormones that lead the individual to negotiate the fear-causing snake with fight-or-flight responses. Whether the individual decides to *fight* the snake or *run* away from it, either action requires energy; in short, the **sympathetic nervous system** says “go, go, go.” The parasympathetic nervous system, on the other hand, curtails undue energy mobilization into muscles and glands and modulates the response by saying “stop, stop, stop.” This push–pull tandem system regulates fight-or-flight responses in all of us.

The Central Nervous System

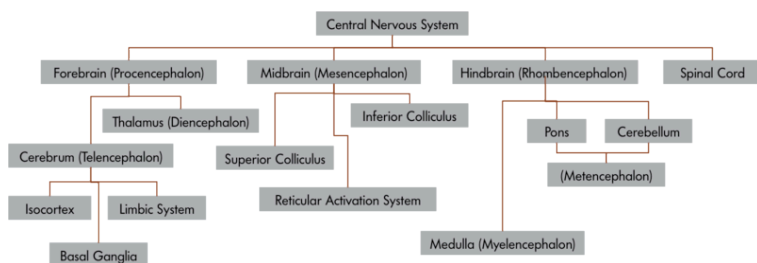


Figure 4 the central nervous system and its components

The central nervous system is divided into a number of important parts (see Figure 4), including the spinal cord, each specialized to perform a set of specific functions. Telencephalon or **cerebrum** is a *newer* development in the evolution of the mammalian nervous system. In humans, it is about the size of a large napkin and when crumpled into the skull, it forms furrows called sulci (singular form, **sulcus**). The bulges between sulci are called gyri (singular form, **gyrus**). The cortex is divided into two hemispheres, and each hemisphere is further divided into four lobes (Figure 5a), which have specific functions. The division of these lobes is based on two delineating sulci: the **central sulcus** divides the hemisphere into frontal and parietal-occipital lobes and the **lateral sulcus** marks the **temporal lobe**, which lies below.

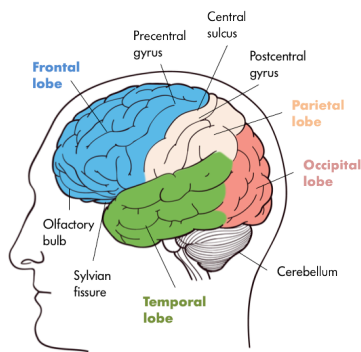


Figure 5a The lobes of the brain

Just in front of the central sulcus lies an area called the **primary motor cortex** (precentral gyrus), which connects to the muscles of the body, and on volitional command moves them. From mastication to movements in the genitalia, the body map is represented on this strip (Figure 5b).

Some body parts, like fingers, thumbs, and lips, occupy a greater representation on the strip than, say, the trunk. This disproportionate representation of the body on the primary motor cortex is called the **magnification factor (Rolls & Cowey, 1970)** and is seen in other motor and sensory areas. At the lower end of the central sulcus, close to the lateral sulcus, lies the **Broca's area** (Figure 6b) in the left **frontal lobe**, which is involved with language production. Damage to this part of the brain led Pierre Paul Broca, a French neuroscientist in 1861,

to document many different forms of **aphasias**, in which his patients would lose the ability to speak or would retain partial speech impoverished in syntax and grammar (**AAAS, 1880**). It is no wonder that others have found subvocal rehearsal and central executive processes of **working memory** in this frontal lobe (**Smith & Jonides, 1997, 1999**).

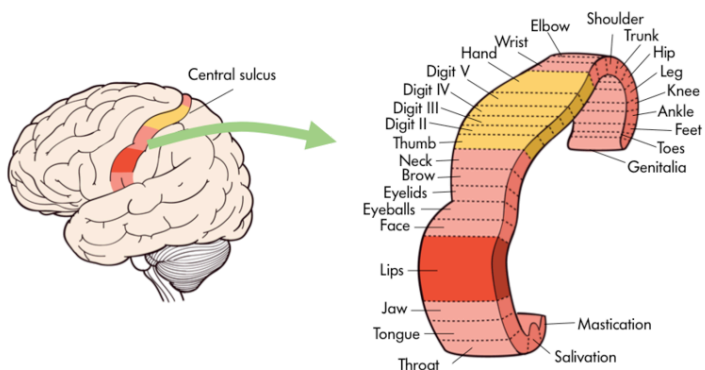


Figure 5b. Specific body parts like the tongue or fingers are mapped onto certain areas of the brain including the primary motor cortex.

Just behind the central gyrus, in the **parietal lobe**, lies the **primary somatosensory cortex** (Figure 6a) on the postcentral gyrus, which represents the whole body receiving inputs from the skin and muscles. The primary somatosensory cortex parallels, abuts, and connects heavily to the primary motor cortex and resembles it in terms of areas devoted to bodily representation. All spinal and some cranial nerves (e.g., the facial nerve) send sensory signals from skin (e.g., touch) and muscles to the primary somatosensory cortex. Close to the lower (ventral) end of this strip, curved inside the parietal lobe, is the taste area (secondary somatosensory cortex), which is involved with taste experiences that originate from the tongue, pharynx, epiglottis, and so forth.

Just below the parietal lobe, and under the caudal end of the lateral fissure, in the temporal lobe, lies the **Wernicke's area** (Demonet et al., 1992). This area is involved with language comprehension and is connected to the Broca's area through the **arcuate fasciculus**, nerve fibers that connect these two regions.

Damage to the Wernicke's area (Figure 6b) results in

many kinds of **agnosias**; agnosia is defined as an inability to know or understand language and speech-related behaviors. So an individual may show word deafness, which is an inability to recognize spoken language, or word blindness, which is an inability to recognize written or printed language. Close in proximity to the Wernicke's area is the primary auditory cortex, which is involved with audition, and finally the brain region devoted to smell (olfaction) is tucked away inside the primary olfactory cortex (prepyriform cortex).

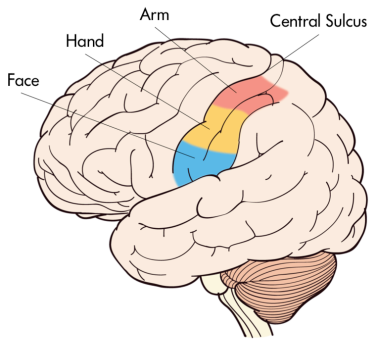


Figure 6a The Primary Somatosensory Cortex

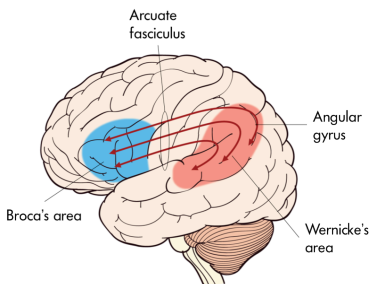


Figure 6b Wernicke's area

At the very back of the cerebral cortex lies the **occipital lobe** housing the primary visual cortex. Optic nerves travel all the way to the **thalamus** (lateral geniculate nucleus, LGN) and then to visual cortex, where images that are received on the retina are projected (Hubel, 1995).

In the past 50 to 60 years, visual sense and visual pathways have been studied

extensively, and our understanding about them has increased manifold. We now understand that all objects that form images on the retina are transformed (**transduction**) in neural language handed down to the visual cortex for further processing. In the visual cortex, all attributes (features) of the image, such as the color, texture, and orientation, are decomposed and processed by different visual cortical modules (**Van Essen, Anderson & Felleman, 1992**) and then recombined to give rise to singular perception of the image in question. If we cut the cerebral hemispheres in the middle, a new set of structures come into view. Many of these perform different functions vital to our being. For example, the **limbic system** contains a number of nuclei that process memory (**hippocampus** and **fornix**) and attention and emotions (**cingulate gyrus**); the **globus pallidus** is involved with motor movements and their coordination; the hypothalamus and thalamus are involved with drives, motivations, and trafficking of sensory and motor throughputs. The **hypothalamus** plays a key role in regulating endocrine hormones in conjunction with the pituitary gland that extends from the hypothalamus through a stalk (infundibulum).

As we descend down the thalamus, the midbrain comes into view with superior and inferior colliculi, which process visual and auditory information, as does the substantia nigra, which is involved with notorious Parkinson's disease, and the reticular formation

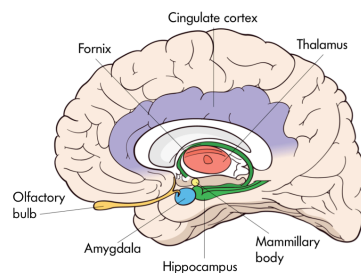


Figure 7 The interior of the brain

regulating arousal, sleep, and temperature. A little lower, the hindbrain with the **pons** processes sensory and motor information employing the cranial nerves, works as a bridge that connects the cerebral cortex with the medulla, and

reciprocally transfers information back and forth between the brain and the spinal cord. The **medulla oblongata** processes breathing, digestion, heart and blood vessel function, swallowing, and sneezing. The **cerebellum** controls motor movement coordination, balance, equilibrium, and muscle tone.

The midbrain and the hindbrain, which make up the brain stem, culminate in the spinal cord. Whereas inside the cerebral cortex, the **gray matter** (neuronal cell bodies) lies outside and **white matter** (myelinated axons) inside; in the spinal cord this arrangement reverses, as the gray matter resides inside and the white matter outside. Paired nerves (ganglia) exit the spinal cord, some closer in direction towards the back (dorsal) and others towards the front (ventral). The dorsal nerves (afferent) receive sensory information from skin and muscles, and ventral nerves (efferent) send signals to muscles and organs to respond.

Studying the Nervous System

The study of the nervous system involves anatomical and physiological techniques that have improved over the years in efficiency and caliber. Clearly, gross morphology of the nervous system requires an eye-level view of the brain and the spinal cord. However, to resolve minute components, optical and electron microscopic techniques are needed.

Light microscopes and, later, electron microscopes have changed our understanding of the intricate connections that exist among nerve cells. For example, modern staining procedures (**immunocytochemistry**) make it possible to see selected neurons that are of one type or another or are affected by growth. With better resolution of the electron microscopes, fine structures like the synaptic cleft between the pre- and post-synaptic neurons can be studied in detail.

Along with the neuroanatomical techniques, a number of other methodologies aid neuroscientists in studying the function and physiology of the nervous system. Early on, **lesion studies** in animals (and study of neurological damage in humans) provided information about the function of the nervous system, by ablating (removing) parts of the nervous system or using neurotoxins to destroy them and documenting the effects on behavior or mental processes. Later, more sophisticated microelectrode techniques were introduced, which led to recording from single neurons in the animal brains and investigating their physiological functions. Such studies led to formulating theories about how sensory and motor information are processed in the brain. To study many neurons (millions of them at a time) electroencephalographic (EEG) techniques were introduced. These methods are used to study how large ensembles of neurons, representing different parts of the nervous system, with (**event-related potentials**) or without stimulation function together. In addition, many scanning techniques that visualize the brain in conjunction with methods mentioned above are used to understand the details of the structure and function of the brain. These include **computerized axial tomography** (CAT), which uses X-rays to capture many pictures of the brain and sandwiches them into 3-D models to study it. The resolution of this method is inferior to **magnetic resonance imaging** (MRI), which is yet another way to capture brain images using large magnets that bobble (precession) hydrogen nuclei in the brain. Although the resolution of MRI scans is much better than CAT scans, they do not provide any functional information about the brain. **Positron Emission Tomography** (PET) involves the acquisition of physiologic (functional) images of the brain based on the detection of positrons. Radio-labeled isotopes of certain chemicals, such as an analog of glucose (fluorodeoxyglucose), enters the active nerve cells and emits positrons, which are captured and

mapped into scans. Such scans show how the brain and its many modules become active (or not) when energized with entering glucose analog. Disadvantages of PET scans include being invasive and rendering poor spatial resolution. The latter is why modern PET machines are coupled with CAT scanners to gain better resolution of the functioning brain. Finally, to avoid the invasiveness of PET, functional MRI (fMRI) techniques were developed. Brain images based on fMRI technique visualize brain function by changes in the flow of fluids (blood) in brain areas that occur over time. These scans provide a wealth of functional information about the brain as the individual may engage in a task, which is why the last two methods of brain scanning are very popular among cognitive neuroscientists.

Understanding the nervous system has been a long journey of inquiry, spanning several hundreds of years of meticulous studies carried out by some of the most creative and versatile investigators in the fields of philosophy, evolution, biology, physiology, anatomy, neurology, neuroscience, cognitive sciences, and psychology. Despite our profound understanding of this organ, its mysteries continue to surprise us, and its intricacies make us marvel at this complex structure unmatched in the universe.

A Video Exploration of the Limbic System

To help you visualize the limbic system, we recommend this video:



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Studying Neurobiology in Queen's Psychology

We have lots of opportunities for you to learn about neurons and the nervous system (including the brain, of course!) in Psychology at Queen's. Some courses you might consider include PSYC271: Brain and Behaviour I, and PSYC370: Brain & Behaviour II.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Afferent nerves

Nerves that carry messages to the brain or spinal cord.

Agnosias

Due to damage of Wernicke's area. An inability to recognize objects, words, or faces.

Aphasia

Due to damage of the Broca's area. An inability to produce or understand words.

Arcuate fasciculus

A fiber tract that connects Wernicke's and Broca's speech areas.

Autonomic nervous system

A part of the peripheral nervous system that connects to glands and smooth muscles. Consists of sympathetic and parasympathetic divisions.

Broca's area

An area in the frontal lobe of the left hemisphere. Implicated in language production.

Central sulcus

The major fissure that divides the frontal and the parietal lobes.

Cerebellum

A nervous system structure behind and below the cerebrum. Controls motor movement coordination, balance, equilibrium, and muscle tone.

Cerebrum

Consists of left and right hemispheres that sit at the top of the nervous system and engages in a variety of higher-order functions.

Cingulate gyrus

A medial cortical portion of the nervous tissue that is a part of the limbic system.

Computerized axial tomography

A noninvasive brain-scanning procedure that uses X-ray absorption around the head.

Ectoderm

The outermost layer of a developing fetus.

Efferent nerves

Nerves that carry messages from the brain to glands and organs in the periphery.

Electroencephalography

A technique that is used to measure gross electrical activity of the brain by placing electrodes on the scalp.

Event-related potentials

A physiological measure of large electrical change in the brain produced by sensory stimulation or motor responses.

Forebrain

A part of the nervous system that contains the cerebral hemispheres, thalamus, and hypothalamus.

Fornix

(plural form, fornices) A nerve fiber tract that connects the hippocampus to mammillary bodies.

Frontal lobe

The most forward region (close to forehead) of the cerebral hemispheres.

Functional magnetic resonance imaging

(or fMRI) A noninvasive brain-imaging technique that registers changes in blood flow in the brain during a given task (also see magnetic resonance imaging).

Globus pallidus

A nucleus of the basal ganglia.

Gray matter

Composes the bark or the cortex of the cerebrum and consists of the cell bodies of the neurons (see also white matter).

Gyrus

(plural form, gyri) A bulge that is raised between or among fissures of the convoluted brain.

Hippocampus

(plural form, hippocampi) A nucleus inside (medial) the temporal lobe implicated in learning and memory.

Homo habilis

A human ancestor, handy man, that lived two million years ago.

Homo sapiens

Modern man, the only surviving form of the genus Homo.

Hypothalamus

Part of the diencephalon. Regulates biological drives with pituitary gland.

Immunocytochemistry

A method of staining tissue including the brain, using antibodies.

Lateral geniculate nucleus

(or LGN) A nucleus in the thalamus that is innervated by the optic nerves and sends signals to the visual cortex in the occipital lobe.

Lateral sulcus

The major fissure that delineates the temporal lobe below the frontal and the parietal lobes.

Lesion studies

A surgical method in which a part of the animal brain is removed to study its effects on behavior or function.

Limbic system

A loosely defined network of nuclei in the brain involved with learning and emotion.

Magnetic resonance imaging

Or MRI is a brain imaging noninvasive technique that uses magnetic energy to generate brain images (also see fMRI).

Magnification factor

Cortical space projected by an area of sensory input (e.g., mm of cortex per degree of visual field).

Medulla oblongata

An area just above the spinal cord that processes

breathing, digestion, heart and blood vessel function, swallowing, and sneezing.

Neural crest

A set of primordial neurons that migrate outside the neural tube and give rise to sensory and autonomic neurons in the peripheral nervous system.

Neural induction

A process that causes the formation of the neural tube.

Neuroblasts

Brain progenitor cells that asymmetrically divide into other neuroblasts or nerve cells.

Neuroepithelium

The lining of the neural tube.

Occipital lobe

The back part of the cerebrum, which houses the visual areas.

Parasympathetic nervous system

A division of the autonomic nervous system that is slower than its counterpart—that is, the sympathetic nervous system—and works in opposition to it. Generally engaged in “rest and digest” functions.

Parietal lobe

An area of the cerebrum just behind the central sulcus that is engaged with somatosensory and gustatory sensation.

Pons

A bridge that connects the cerebral cortex with the medulla, and reciprocally transfers information back and forth between the brain and the spinal cord.

Positron Emission Tomography

(or PET) An invasive procedure that captures brain images with positron emissions from the brain after the individual has been injected with radio-labeled isotopes.

Primary Motor Cortex

A strip of cortex just in front of the central sulcus that is involved with motor control.

Primary Somatosensory Cortex

A strip of cerebral tissue just behind the central sulcus engaged in sensory reception of bodily sensations.

Rostrocaudal

A front-back plane used to identify anatomical structures in the body and the brain.

Somatic nervous system

A part of the peripheral nervous system that uses cranial and spinal nerves in volitional actions.

Spina bifida

A developmental disease of the spinal cord, where the neural tube does not close caudally.

Sulcus

(plural form, sulci) The crevices or fissures formed by convolutions in the brain.

Sympathetic nervous system

A division of the autonomic nervous system, that is faster than its counterpart that is the parasympathetic nervous system and works in opposition to it. Generally engaged in “fight or flight” functions.

Temporal lobe

An area of the cerebrum that lies below the lateral sulcus; it contains auditory and olfactory (smell) projection

regions.

Thalamus

A part of the diencephalon that works as a gateway for incoming and outgoing information.

Transduction

A process in which physical energy converts into neural energy.

Wernicke's area

A language area in the temporal lobe where linguistic information is comprehended (Also see Broca's area).

White matter

Regions of the nervous system that represent the axons of the nerve cells; whitish in color because of myelination of the nerve cells.

Working memory

Short transitory memory processed in the hippocampus.

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18. The Brain

Original chapter by Diane Beck and Evelina Tapia adapted by the Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

The human brain is responsible for all behaviors, thoughts, and experiences described in this textbook. This module provides an introductory overview of the brain, including some basic neuroanatomy, and brief descriptions of the neuroscience methods used to study it.

Learning Objectives

- Name and describe the basic function of the brain stem, cerebellum, and cerebral hemispheres.
- Name and describe the basic function of the four cerebral lobes: occipital, temporal, parietal, and frontal cortex.
- Describe a split-brain patient and at least two important aspects of brain function that these patients reveal.
- Distinguish between gray and white matter of the cerebral hemispheres.
- Name and describe the most common approaches to studying the human brain.

- Distinguish among four neuroimaging methods: PET, fMRI, EEG, and DOI.
- Describe the difference between spatial and temporal resolution with regard to brain function.

Introduction

Any textbook on psychology would be incomplete without reference to the brain. Every behavior, thought, or experience described in the other modules must be implemented in the brain. A detailed understanding of the human brain can help us make sense of human experience and behavior. For example, one well-established fact about human cognition is that it is limited. We cannot do two complex tasks at once: We cannot read and carry on a conversation at the same time, text and drive, or surf the Internet while listening to a lecture, at least not successfully or safely. We cannot even pat our head and rub our stomach at the same time (with exceptions, see section “A Brain Divided” below). Why is this? Many people have suggested that such limitations reflect the fact that the behaviors draw on the same resource; if one behavior uses up most of the resource there is not enough resource left for the other. But what might this limited resource be in the brain?

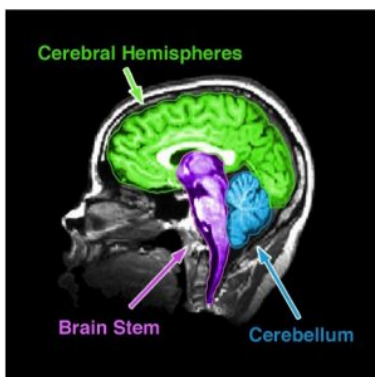


Figure 1. An MRI of the human brain delineating three major structures: the cerebral hemispheres, brain stem, and cerebellum.

The brain uses oxygen and glucose, delivered via the blood. The brain is a large consumer of these **metabolites**, using 20% of the oxygen and calories we consume despite being only 2% of our total weight. However, as long as we are not oxygen-deprived or malnourished, we have more than enough oxygen and glucose to fuel the brain. Thus, insufficient “brain fuel” cannot explain our limited

capacity. Nor is it likely that our limitations reflect too few neurons. The average human brain contains 100 billion neurons. It is also not the case that we use only 10% of our brain, a myth that was likely started to imply we had untapped potential. Modern neuroimaging (see section “Studying the Human Brain” below) has shown that we use all parts of brain, just at different times, and certainly more than 10% at any one time.

If we have an abundance of brain fuel and neurons, how can we explain our limited cognitive abilities? Why can’t we do more at once? The most likely explanation is the way these neurons are wired up. We know, for instance, that many neurons in the visual cortex (the part of the brain responsible for processing visual information) are hooked up in such a way as to inhibit each other (**Beck & Kastner, 2009**). When one neuron fires, it suppresses the firing of other nearby neurons. If two neurons that are hooked up in an inhibitory way both fire, then neither neuron can fire as vigorously as it would otherwise. This competitive behavior among neurons limits how much visual information the brain can respond to at the

same time. Similar kinds of competitive wiring among neurons may underlie many of our limitations. Thus, although talking about limited resources provides an intuitive description of our limited capacity behavior, a detailed understanding of the brain suggests that our limitations more likely reflect the complex way in which neurons talk to each other rather than the depletion of any specific resource.

The Anatomy of the Brain

There are many ways to subdivide the mammalian brain, resulting in some inconsistent and ambiguous **nomenclature** over the history of neuroanatomy (**Swanson, 2000**). For simplicity, we will divide the brain into three basic parts: the brain stem, cerebellum, and cerebral hemispheres (see Figure 1). In Figure 2, however, we depict other prominent groupings (**Swanson, 2000**) of the six major subdivisions of the brain (**Kandal, Schwartz, & Jessell, 2000**).

Brain Stem

The **brain stem** is sometimes referred to as the “trunk” of the brain. It is responsible for many of the neural functions that keep us alive, including regulating our respiration (breathing), heart rate, and digestion. In keeping with its function, if a patient sustains severe damage to the brain stem he or she will require “life support” (i.e., machines are used to keep him or her alive). Because of its vital role in survival, in many countries a person who has lost brain stem function is said to be “brain dead,” although other countries require significant tissue loss in the cortex (of the cerebral hemispheres), which is responsible for our conscious experience, for the same

diagnosis. The brain stem includes the medulla, pons, midbrain, and diencephalon (which consists of thalamus and hypothalamus). Collectively, these regions also are involved in our sleep–wake cycle, some sensory and motor function, as well as growth and other hormonal behaviors.

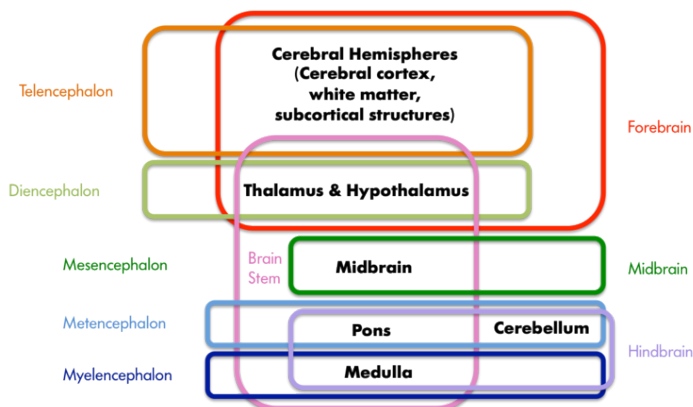


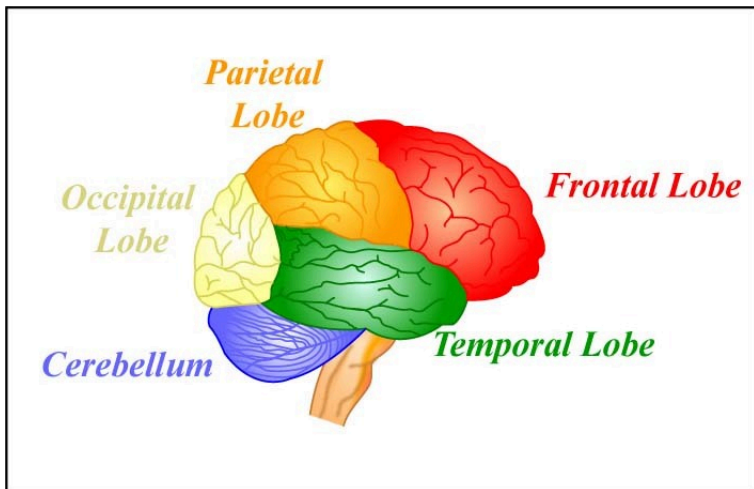
Figure 2. A sample of neuroanatomy nomenclature. The colored boxes indicate the different groupings of the seven structures printed in black, with the labels matching the color of the boxes. The hindbrain, midbrain, and forebrain nomenclature stems from the development of the vertebrate brain; these three areas differentiate early in embryonic development and later give rise to the structures listed in black. These three areas further subdivide into the telencephalon, diencephalon, mesencephalon, metencephalon, and myelencephalon at a later stage of development.

Cerebellum

The **cerebellum** is the distinctive structure at the back of the brain. The Greek philosopher and scientist Aristotle aptly referred to it as the “small brain” (“*parencephalon*” in Greek, “*cerebellum*” in Latin) in order to distinguish it from the “large brain” (“*encephalon*” in Greek, “***cerebrum***” in Latin). The cerebellum is critical for coordinated movement and posture. More recently, neuroimaging studies (see section “Studying

the Human Brain” below) have implicated it in a range of cognitive abilities, including language. It is perhaps not surprising that the cerebellum’s influence extends beyond that of movement and posture, given that it contains the greatest number of neurons of any structure in the brain. However, the exact role it plays in these higher functions is still a matter of further study.

Cerebral Hemispheres



The four lobes of the brain and the cerebellum. [Image: MIT OpenCourseWare, <https://goo.gl/RwUEVt>, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

The **cerebral hemispheres** are responsible for our cognitive abilities and conscious experience. They consist of the **cerebral cortex** and accompanying white matter (“cerebrum” in Latin) as well as the **subcortical** structures of the basal ganglia, amygdala, and hippocampal formation. The cerebral cortex is

the largest and most visible part of the brain, retaining the Latin name (cerebrum) for “large brain” that Aristotle coined. It consists of two hemispheres (literally two half spheres) and gives the brain its characteristic gray and convoluted appearance; the folds and grooves of the cortex are called **gyri** and **sulci** (**gyrus** and **sulcus** if referring to just one), respectively.

The two cerebral hemispheres can be further subdivided into four lobes: the occipital, temporal, parietal, and frontal lobes. The **occipital lobe** is responsible for vision, as is much of the temporal lobe. The **temporal lobe** is also involved in auditory processing, memory, and multisensory integration (e.g., the convergence of vision and audition). The **parietal lobe** houses the **somatosensory (body sensations) cortex** and structures involved in visual attention, as well as multisensory convergence zones. The **frontal lobe** houses the **motor cortex** and structures involved in motor planning, language, judgment, and decision-making. Not surprisingly then, the frontal lobe is proportionally larger in humans than in any other animal.

The subcortical structures are so named because they reside beneath the cortex. The **basal ganglia** are critical to voluntary movement and as such make contact with the cortex, the thalamus, and the brain stem. The amygdala and hippocampal formation are part of the **limbic system**, which also includes some cortical structures. The limbic system plays an important role in emotion and, in particular, in aversion and gratification.

A Brain Divided

The two cerebral hemispheres are connected by a dense bundle of white matter tracts called the corpus callosum. Some functions are replicated in the two hemispheres. For example, both hemispheres are responsible for sensory and motor function, although the sensory and motor cortices have a

contralateral (or opposite-side) representation; that is, the left cerebral hemisphere is responsible for movements and sensations on the right side of the body and the right cerebral hemisphere is responsible for movements and sensations on the left side of the body. Other functions are **lateralized**; that is, they reside primarily in one hemisphere or the other. For example, for right-handed and the majority of left-handed individuals, the left hemisphere is most responsible for language. There are some people whose two hemispheres are not connected, either because the corpus callosum was surgically severed (**callosotomy**) or due to a genetic abnormality. These **split-brain patients** have helped us understand the functioning of the two hemispheres. First, because of the contralateral representation of sensory information, if an object is placed in only the left or only the right **visual hemifield**, then only the right or left hemisphere, respectively, of the split-brain patient will see it. In essence, it is as though the person has two brains in his or her head, each seeing half the world. Interestingly, because language is very often localized in the left hemisphere, if we show the right hemisphere a picture and ask the patient what she saw, she will say she didn't see anything (because only the left hemisphere can speak and it didn't see anything). However, we know that the right hemisphere sees the picture because if the patient is asked to press a button whenever she sees the image, the left hand (which is controlled by the right hemisphere) will respond despite the left hemisphere's denial that anything was there. There are also some advantages to having disconnected hemispheres. Unlike those with a fully functional corpus callosum, a split-brain patient can simultaneously search for something in his right and left visual fields (**Luck, Hillyard, Mangun, & Gazzaniga, 1989**) and can do the equivalent of rubbing his stomach and patting his head at the same time (**Franz, Eliason, Ivry, & Gazzaniga, 1996**). In other words, they exhibit less competition between the hemispheres.

Gray Versus White Matter

The cerebral hemispheres contain both grey and white matter, so called because they appear grayish and whitish in dissections or in an MRI (magnetic resonance imaging; see section “Studying the Human Brain” below). The **gray matter** is composed of the neuronal cell bodies (see module, “Neurons”). The cell bodies (or soma) contain the genes of the cell and are responsible for metabolism (keeping the cell alive) and synthesizing proteins. In this way, the cell body is the workhorse of the cell. The **white matter** is composed of the axons of the neurons, and, in particular, axons that are covered with a sheath of **myelin** (fatty support cells that are whitish in color). Axons conduct the electrical signals from the cell and are, therefore, critical to cell communication. People use the expression “use your gray matter” when they want a person to think harder. The “gray matter” in this expression is probably a reference to the cerebral hemispheres more generally; the gray cortical sheet (the convoluted surface of the cortex) being the most visible. However, both the gray matter and white matter are critical to proper functioning of the mind. Losses of either result in deficits in language, memory, reasoning, and other mental functions. See Figure 3 for MRI slices showing both the inner white matter that connects the cell bodies in the gray cortical sheet.

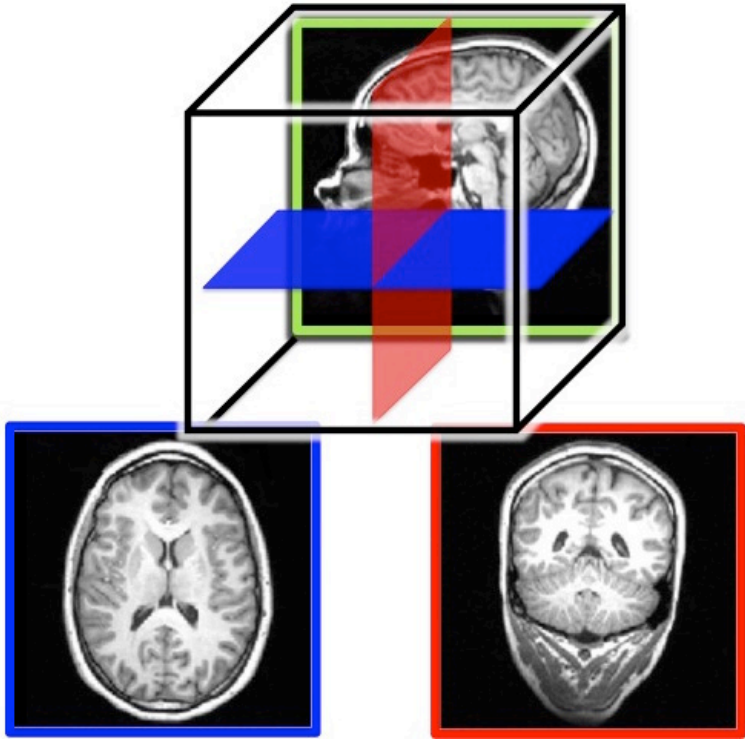


Figure 3. MRI slices of the human brain. Both the outer gray matter and inner white matter are visible in each image. The brain is a three-dimensional (3-D) structure, but an image is two-dimensional (2-D). Here, we show example slices of the three possible 2-D cuts through the brain: a sagittal slice (top image), a horizontal slice (bottom left), which is also known as a transverse or axial slice, and a coronal slice (bottom right). The bottom two images are color coded to match the illustration of the relative orientations of the three slices in the top image.

Studying the Human Brain

How do we know what the brain does? We have gathered knowledge about the functions of the brain from many different methods. Each method is useful for answering

distinct types of questions, but the strongest evidence for a specific role or function of a particular brain area is **converging evidence**; that is, similar findings reported from multiple studies using different methods. One of the first organized attempts to study the functions of the brain was **phrenology**, a popular field of study in the first half of the 19th century. Phrenologists assumed that various features of the brain, such as its uneven surface, are reflected on the skull; therefore, they attempted to correlate bumps and indentations of the skull with specific functions of the brain. For example, they would claim that a very artistic person has ridges on the head that vary in size and location from those of someone who is very good at spatial reasoning. Although the assumption that the skull reflects the underlying brain structure has been proven wrong, phrenology nonetheless significantly impacted current-day neuroscience and its thinking about the functions of the brain. That is, different parts of the brain are devoted to very specific functions that can be identified through scientific inquiry.

Neuroanatomy

Dissection of the brain, in either animals or cadavers, has been a critical tool of neuroscientists since 340 BC when Aristotle first published his dissections. Since then this method has advanced considerably with the discovery of various staining techniques that can highlight particular cells. Because the brain can be sliced very thinly, examined under the microscope, and particular cells highlighted, this method is especially useful for studying specific groups of neurons or small brain structures; that is, it has a very high **spatial resolution**. Dissections allow scientists to study changes in the brain that occur due to various diseases or experiences (e.g., exposure to drugs or brain injuries). Virtual dissection studies

with living humans are also conducted. Here, the brain is imaged using computerized axial tomography (CAT) or MRI scanners; they reveal with very high precision the various structures in the brain and can help detect changes in gray or white matter. These changes in the brain can then be correlated with behavior, such as performance on memory tests, and, therefore, implicate specific brain areas in certain cognitive functions.

Changing the Brain

Some researchers induce **lesions** or **ablate** (i.e., remove) parts of the brain in animals. If the animal's behavior changes after the lesion, we can infer that the removed structure is important for that behavior. Lesions of human brains are studied in patient populations only; that is, patients who have lost a brain region due to a stroke or other injury, or who have had surgical removal of a structure to treat a particular disease (e.g., a callosotomy to control epilepsy, as in split-brain patients). From such **case studies**, we can infer brain function by measuring changes in the behavior of the patients before and after the lesion. Because the brain works by generating electrical signals, it is also possible to change brain function with electrical stimulation. **Transcranial magnetic stimulation (TMS)** refers to a technique whereby a brief magnetic pulse is applied to the head that temporarily induces a weak electrical current in the brain. Although effects of TMS are sometimes referred to as temporary virtual lesions, it is more appropriate to describe the induced electricity as interference with neurons' normal communication with each other. TMS allows very precise study of when events in the brain happen so it has a good **temporal resolution**, but its application is limited only to the surface of the cortex and cannot extend to deep areas of the brain. **Transcranial direct current stimulation (tDCS)** is similar to TMS

except that it uses electrical current directly, rather than inducing it with magnetic pulses, by placing small electrodes on the skull. A brain area is stimulated by a low current (equivalent to an AA battery) for a more extended period of time than TMS. When used in combination with cognitive training, tDCS has been shown to improve performance of many cognitive functions such as mathematical ability, memory, attention, and coordination (e.g., **Brasil-Neto, 2012; Feng, Bowden, & Kautz, 2013; Kuo & Nitsche, 2012**).

Neuroimaging

Neuroimaging tools are used to study the brain in action; that is, when it is engaged in a specific task. **Positron emission tomography (PET)** records blood flow in the brain. The PET scanner detects the radioactive substance that is injected into the bloodstream of the participant just before or while he or she is performing some task (e.g., adding numbers). Because active neuron populations require metabolites, more blood and hence more radioactive substance flows into those regions. PET scanners detect the injected radioactive substance in specific brain regions, allowing researchers to infer that those areas were active during the task. **Functional magnetic resonance imaging (fMRI)** also relies on blood flow in the brain. This method, however, measures the changes in oxygen levels in the blood and does not require any substance to be injected into the participant. Both of these tools have good spatial resolution (although not as precise as dissection studies), but because it takes at least several seconds for the blood to arrive to the active areas of the brain, PET and fMRI have poor temporal resolution; that is, they do not tell us very precisely when the activity occurred.



A researcher looking at the areas of activation in the brain of a study participant who had an fMRI scan – areas of brain activation are determined by the amount of blood flow to a certain area – the more blood flow, the higher the activation of that area of the brain. [Image: National Institute of Mental Health, CCO Public Domain, <https://goo.gl/m25gce>]

Electroencephalography (EEG), on the other hand, measures the electrical activity of the brain, and therefore, it has a much greater temporal resolution (millisecond precision rather than seconds) than PET or fMRI. Like tDCS, electrodes are placed on the participant's head when he or she is performing a task. In this case, however, many more electrodes are used, and they measure rather than produce activity. Because the electrical activity picked up at any particular electrode can be coming from anywhere in the brain, EEG has poor spatial resolution; that is, we have only a rough idea of which part of the brain generates the measured activity.

Diffuse optical imaging (DOI) can give researchers the best of both worlds: high spatial and temporal resolution, depending on how it is used. Here, one shines infrared light into the brain, and measures the light that comes back out. DOI relies on the fact that the properties of the light change when it passes through oxygenated blood, or when it encounters active neurons. Researchers can then infer from

the properties of the collected light what regions in the brain were engaged by the task. When DOI is set up to detect changes in blood oxygen levels, the temporal resolution is low and comparable to PET or fMRI. However, when DOI is set up to directly detect active neurons, it has both high spatial and temporal resolution.

Because the spatial and temporal resolution of each tool varies, strongest evidence for what role a certain brain area serves comes from converging evidence. For example, we are more likely to believe that the hippocampal formation is involved in memory if multiple studies using a variety of tasks and different neuroimaging tools provide evidence for this hypothesis. The brain is a complex system, and only advances in brain research will show whether the brain can ever really understand itself.

Unpacking Left Brain vs Right Brain

The concept of lateralization of function is more complicated than pop media presents. In this video, shared by Society for Neuroscience, Michael Colacci, a medical school student at Northwestern University Feinberg School of Medicine, unpacks some of the misunderstandings associated with lateralization of function.



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view them online here:

<https://ecampusontario.pressbooks.pub/testbookje/?p=519#oembed-1>

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.

Click “Read” and hover over the “+” signs to check your knowledge of that brain region:



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Vocabulary

Ablation

Surgical removal of brain tissue.

Axial plane

See “horizontal plane.”

Basal ganglia

Subcortical structures of the cerebral hemispheres involved in voluntary movement.

Brain stem

The “trunk” of the brain comprised of the medulla, pons, midbrain, and diencephalon.

Callosotomy

Surgical procedure in which the corpus callosum is severed (used to control severe epilepsy).

Case study

A thorough study of a patient (or a few patients) with naturally occurring lesions.

Cerebellum

The distinctive structure at the back of the brain, Latin for “small brain.”

Cerebral cortex

The outermost gray matter of the cerebrum; the distinctive convolutions characteristic of the mammalian brain.

Cerebral hemispheres

The cerebral cortex, underlying white matter, and subcortical structures.

Cerebrum

Usually refers to the cerebral cortex and associated white matter, but in some texts includes the subcortical structures.

Contralateral

Literally “opposite side”; used to refer to the fact that the two hemispheres of the brain process sensory information and motor commands for the opposite side of the body (e.g., the left hemisphere controls the right side of the body).

Converging evidence

Similar findings reported from multiple studies using different methods.

Coronal plane

A slice that runs from head to foot; brain slices in this plane are similar to slices of a loaf of bread, with the eyes being the front of the loaf.

Diffuse optical imaging (DOI)

A neuroimaging technique that infers brain activity by measuring changes in light as it is passed through the skull and surface of the brain.

Electroencephalography (EEG)

A neuroimaging technique that measures electrical brain activity via multiple electrodes on the scalp.

Frontal lobe

The front most (anterior) part of the cerebrum; anterior to the central sulcus and responsible for motor output and planning, language, judgment, and decision-making.

Functional magnetic resonance imaging (fMRI)

Functional magnetic resonance imaging (fMRI): A neuroimaging technique that infers brain activity by measuring changes in oxygen levels in the blood.

Gray matter

The outer grayish regions of the brain comprised of the neurons’ cell bodies.

Gyri

(plural) Folds between sulci in the cortex.

Gyrus

A fold between sulci in the cortex.

Horizontal plane

A slice that runs horizontally through a standing person (i.e., parallel to the floor); slices of brain in this plane divide the top and bottom parts of the brain; this plane is similar to slicing a hamburger bun.

Lateralized

To the side; used to refer to the fact that specific functions may reside primarily in one hemisphere or the other (e.g., for the majority individuals, the left hemisphere is most responsible for language).

Lesion

A region in the brain that suffered damage through injury, disease, or medical intervention.

Limbic system

Includes the subcortical structures of the amygdala and hippocampal formation as well as some cortical structures; responsible for aversion and gratification.

Metabolite

A substance necessary for a living organism to maintain life.

Motor cortex

Region of the frontal lobe responsible for voluntary movement; the motor cortex has a contralateral representation of the human body.

Myelin

Fatty tissue, produced by glial cells (see module,

“Neurons”) that insulates the axons of the neurons; myelin is necessary for normal conduction of electrical impulses among neurons.

Nomenclature

Naming conventions.

Occipital lobe

The back most (posterior) part of the cerebrum; involved in vision.

Parietal lobe

The part of the cerebrum between the frontal and occipital lobes; involved in bodily sensations, visual attention, and integrating the senses.

Phrenology

A now-discredited field of brain study, popular in the first half of the 19th century that correlated bumps and indentations of the skull with specific functions of the brain.

Positron emission tomography (PET)

A neuroimaging technique that measures brain activity by detecting the presence of a radioactive substance in the brain that is initially injected into the bloodstream and then pulled in by active brain tissue.

Sagittal plane

A slice that runs vertically from front to back; slices of brain in this plane divide the left and right side of the brain; this plane is similar to slicing a baked potato lengthwise.

Somatosensory (body sensations) cortex

The region of the parietal lobe responsible for bodily sensations; the somatosensory cortex has a contralateral representation of the human body.

Spatial resolution

A term that refers to how small the elements of an image are; high spatial resolution means the device or technique can resolve very small elements; in neuroscience it describes how small of a structure in the brain can be imaged.

Split-brain patient

A patient who has had most or all of his or her corpus callosum severed.

Subcortical

Structures that lie beneath the cerebral cortex, but above the brain stem.

Sulci

(plural) Grooves separating folds of the cortex.

Sulcus

A groove separating folds of the cortex.

Temporal lobe

The part of the cerebrum in front of (anterior to) the occipital lobe and below the lateral fissure; involved in vision, auditory processing, memory, and integrating vision and audition.

Temporal resolution

A term that refers to how small a unit of time can be measured; high temporal resolution means capable of resolving very small units of time; in neuroscience it describes how precisely in time a process can be measured in the brain.

Transcranial direct current stimulation (tDCS)

A neuroscience technique that passes mild electrical current directly through a brain area by placing small electrodes on the skull.

Transcranial magnetic stimulation (TMS)

A neuroscience technique whereby a brief magnetic pulse is applied to the head that temporarily induces a weak electrical current that interferes with ongoing activity.

Transverse plane

See “horizontal plane.”

Visual hemifield

The half of visual space (what we see) on one side of fixation (where we are looking); the left hemisphere is responsible for the right visual hemifield, and the right hemisphere is responsible for the left visual hemifield.

White matter

The inner whitish regions of the cerebrum comprised of the myelinated axons of neurons in the cerebral cortex.

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19. Psychophysiological Methods in Neuroscience

Original chapter by Zachary Infantolino and Gregory A. Miller adapted by the Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below. We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link:
<https://sass.queensu.ca/psyc100/>

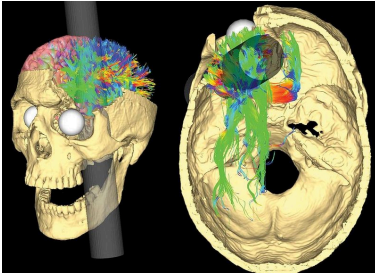
As a generally noninvasive subset of neuroscience methods, psychophysiological methods are used across a variety of disciplines in order to answer diverse questions about psychology, both mental events and behavior. Many different techniques are classified as psychophysiological. Each technique has its strengths and weaknesses, and knowing them allows researchers to decide what each offers for a particular question. Additionally, this knowledge allows research consumers to evaluate the meaning of the results in a particular experiment.

Learning Objectives

- Learn what qualifies as psychophysiology within the broader field of neuroscience.
- Review and compare several examples of psychophysiological methods.
- Understand advantages and disadvantages of different psychophysiological methods.

History

In the mid-19th century, a railroad worker named Phineas Gage was in charge of setting explosive charges for blasting through rock in order to prepare a path for railroad tracks. He would lay the charge in a hole drilled into the rock, place a fuse and sand on top of the charge, and pack it all down using a tamping iron (a solid iron rod approximately one yard long and a little over an inch in diameter). On a September afternoon when Gage was performing this task, his tamping iron caused a spark that set off the explosive prematurely, sending the tamping iron flying through the air.



Unlike other areas of the body, damage to the brain isn't localized to that specific region; injuries have widespread consequences for other areas, too. [Image: Van Horn JD, Irimia A, Torgerson CM, Chambers MC, Kikinis R, et al., <https://goo.gl/wdhM4o>, CC BY 2.5, <https://goo.gl/OQtWcf>]

Unfortunately for Gage, his head was above the hole and the tamping iron entered the side of his face, passed behind his left eye, and exited out of the top of his head, eventually landing 80 feet away. Gage lost a portion of his left frontal lobe in the accident, but survived and lived for another 12 years. What is most interesting from a psychological perspective is that Gage's personality changed as a

result of this accident. He became more impulsive, he had trouble carrying out plans, and, at times, he engaged in vulgar profanity, which was out of character. This case study leads one to believe that there are specific areas of the brain that are associated with certain psychological phenomena. When studying psychology, the brain is indeed an interesting source of information. Although it would be impossible to replicate the type of damage done to Gage in the name of research, methods have developed over the years that are able to safely measure different aspects of nervous system activity in order to help researchers better understand psychology as well as the relationship between psychology and biology.

Introduction

Psychophysiology is defined as any research in which the dependent variable (what the researcher measures) is a physiological measure, and the independent variable (what the researcher manipulates) is behavioral or mental. In most cases

the work is done noninvasively with awake human participants. Physiological measures take many forms and range from blood flow or neural activity in the brain to heart rate variability and eye movements. These measures can provide information about processes including emotion, cognition, and the interactions between them. In these ways, physiological measures offer a very flexible set of tools for researchers to answer questions about behavior, cognition, and health.

Psychophysiological methods are a subset of the very large domain of **neuroscience methods**. Many neuroscience methods are **invasive**, such as involving **lesions** of neural tissue, injection of neutrally active chemicals, or manipulation of neural activity via electrical stimulation. The present survey emphasizes **noninvasive** methods widely used with human subjects.

Crucially, in examining the relationship between physiology and overt behavior or mental events, psychophysiology does not attempt to replace the latter with the former. As an example, happiness is a state of pleasurable contentment and is associated with various physiological measures, but one would not say that those physiological measures *are* happiness. We can make inferences about someone's cognitive or emotional state based on his or her self-report, physiology, or overt behavior. Sometimes our interest is primarily in inferences about internal events and sometimes primarily in the physiology itself. Psychophysiology addresses both kinds of goals.

Central Nervous System (CNS)

This module provides an overview of several popular psychophysiological methods, though it is far from exhaustive. Each method can draw from a broad range of data-analysis strategies to provide an even more expansive set of tools. The psychophysiological methods discussed below focus on the central nervous system. Structural magnetic resonance imaging (sMRI) is a noninvasive technique that



The adult human brain only makes up about 2% (i.e. ≈ 3 pounds) of the average adult's weight, but it uses 20% of the body's energy! [Image: _DJ_, <https://goo.gl/eHPh5L>, CC BY-SA 2.0, <https://goo.gl/rxiUsF>]

allows researchers and clinicians to view anatomical structures within a human. The participant is placed in a magnetic field that may be 66,000 times greater than the Earth's magnetic field, which causes a small portion of the atoms in his or her body to line up in the same direction. The body is then pulsed with low-energy radio frequencies that are absorbed by the atoms in the body, causing them to tip over. As these atoms return to their aligned state, they give off energy in the form of harmless electromagnetic radiation, which is measured by the machine. The machine then transforms the measured energy into a three-dimensional picture of the tissue within the body. In psychophysiology research, this image may be used to compare the size of structures in different groups of people (e.g., are areas associated with pleasure smaller in individuals with depression?) or to increase the accuracy of spatial locations as measured with functional magnetic resonance imaging (fMRI).

Functional magnetic resonance imaging (fMRI) is a method

that is used to assess changes in activity of tissue, such as measuring changes in neural activity in different areas of the brain during thought. This technique builds on the principles of sMRI and also uses the property that, when neurons fire, they use energy, which must be replenished. Glucose and oxygen, two key components for energy production, are supplied to the brain from the blood stream as needed. Oxygen is transported through the blood using **hemoglobin**, which contains binding sites for oxygen. When these sites are saturated with oxygen, it is referred to as **oxygenated hemoglobin**. When the oxygen molecules have all been released from a hemoglobin molecule, it is known as **deoxygenated hemoglobin**. As a set of neurons begin firing, oxygen in the blood surrounding those neurons is consumed, leading to a reduction in oxygenated hemoglobin. The body then compensates and provides an abundance of oxygenated hemoglobin in the blood surrounding that activated neural tissue. When activity in that neural tissue declines, the level of oxygenated hemoglobin slowly returns to its original level, which typically takes several seconds.

fMRI measures the change in the concentration of oxygenated hemoglobin, which is known as the **blood-oxygen-level-dependent (BOLD)** signal. This leads to two important facts about fMRI. First, fMRI measures blood volume and blood flow, and from this we infer neural activity; fMRI does not measure neural activity directly. Second, fMRI data typically have poor **temporal resolution** (the precision of measurement with respect to time); however, when combined with sMRI, fMRI provides excellent **spatial resolution** (the ability to distinguish one object from another in space). Temporal resolution for fMRI is typically on the order of seconds, whereas its spatial resolution is on the order of millimeters. Under most conditions there is an inverse relationship between temporal and spatial resolution—one can increase temporal resolution at the expense of spatial resolution and vice versa.

This method is valuable for identifying specific areas of the

brain that are associated with different physical or psychological tasks. Clinically, fMRI may be used prior to neurosurgery in order to identify areas that are associated with language so that the surgeon can avoid those areas during the operation. fMRI allows researchers to identify differential or convergent patterns of activation associated with tasks. For example, if participants are shown words on a screen and are expected to indicate the color of the letters, are the same brain areas recruited for this task if the words have emotional content or not? Does this relationship change in psychological disorders such as anxiety or depression? Is there a different pattern of activation even in the absence of overt performance differences? fMRI is an excellent tool for comparing brain activation in different tasks and/or populations. Figure 1 provides an example of results from fMRI analyses overlaid on an sMRI image. The blue and orange shapes represent areas with significant changes in the BOLD signal, thus changes in neural activation.

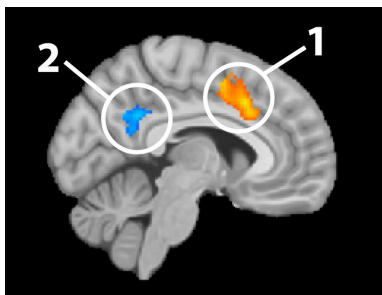


Figure 1. Example of fMRI analyses overlaid on an sMRI image. Area 1 (orange) indicates an increase in the BOLD signal, and Area 2 (blue) indicates a decrease in the BOLD signal. We infer that neural activity increased in the Area 1 and decreased in Area 2.

Electroencephalography (EEG) is another technique for studying brain activation. This technique uses at least two and sometimes up to 256 electrodes to measure the difference in electrical charge (the **voltage**) between pairs of points on the head. These electrodes are typically fastened to a flexible cap (similar to a swimming cap) that is placed on the participant's head. From the scalp, the electrodes

measure the electrical activity that is naturally occurring within the brain. They do not introduce any new electrical activity. In

contrast to fMRI, EEG measures neural activity directly, rather than a correlate of that activity.

Electrodes used in EEG can also be placed within the skull, resting directly on the brain itself. This application, called electrocorticography (ECoG), is typically used prior to medical procedures for localizing activity, such as the origin of epileptic seizures. This invasive procedure allows for more precise localization of neural activity, which is essential in medical applications. However, it is generally not justifiable to open a person's skull solely for research purposes, and instead electrodes are placed on the participant's scalp, resulting in a noninvasive technique for measuring neural activity.

Given that this electrical activity must travel through the skull and scalp before reaching the electrodes, localization of activity is less precise when measuring from the scalp, but it can still be within several millimeters when localizing activity that is near the scalp. One major advantage of EEG is its temporal resolution. Data can be recorded thousands of times per second, allowing researchers to document events that happen in less than a millisecond. EEG analyses typically investigate the change in amplitude or frequency components of the recorded EEG on an ongoing basis or averaged over dozens of trials (see Figure 2).

Magnetoencephalography (MEG) is another technique for noninvasively measuring neural activity. The flow of electrical charge (the current) associated with neural activity produces very weak magnetic fields that can be detected by sensors placed near the participant's scalp. The number of sensors used varies from a few to several hundred. Due to the fact that the magnetic fields of interest are so small, special rooms that are shielded from magnetic fields in the environment are needed in order to avoid

contamination of the signal being measured. MEG has the same excellent temporal resolution as EEG. Additionally, MEG is not as susceptible to distortions from the skull and scalp. Magnetic fields are able to pass through the hard and soft tissue relatively unchanged, thus providing better spatial resolution than EEG. MEG analytic strategies are nearly identical to those used in EEG. However, the MEG recording apparatus is much more expensive than EEG, so MEG is much less widely available.

EEG and MEG are both excellent for elucidating the temporal dynamics of neural processes. For example, if someone is reading a sentence that ends with an unexpected word (e.g., Michelle is going outside to water the book), how long after he or she reads the unexpected word does he or she recognize this as unexpected? In addition to these types of questions, EEG and MEG methods allow researchers to investigate the

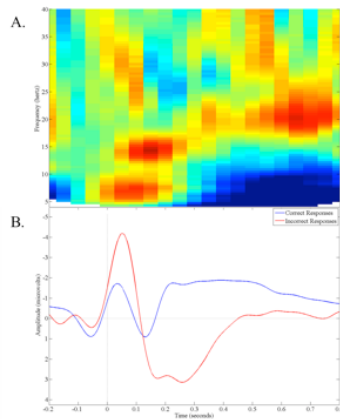


Figure 2. Example of EEG analysis output. Panel A represents changes in the relative strength of different frequencies in the EEG data over time. Panel B represents changes in the amplitude in the instantaneous EEG voltage over time.

degree to which different parts of the brain “talk” to each other. This allows for a better understanding of brain networks, such as their role in different tasks and how they may function abnormally in psychopathology.

Positron emission tomography (PET) is a medical imaging technique that is used to measure processes in the body, including the brain. This method relies on a positron-emitting tracer atom that is introduced into the blood stream in a biologically active molecule, such as glucose, water, or ammonia. A **positron** is a particle much like an electron but with a positive charge. One example of a biologically active molecule is fludeoxyglucose, which acts similarly to glucose in the body. Fludeoxyglucose will concentrate in areas where glucose is needed—commonly areas with higher metabolic needs. Over time, this tracer molecule emits positrons, which are detected by a sensor. The spatial location of the tracer molecule in the brain can be determined based on the emitted positrons. This allows researchers to construct a three-dimensional image of the areas of the brain that have the highest metabolic needs, typically those that are most active. Images resulting from PET usually represent neural activity that has occurred over tens of minutes, which is very poor temporal resolution for some purposes. PET images are often combined with computed tomography (CT) images to improve spatial resolution, as fine as several millimeters. Tracers can also be incorporated into molecules that bind to neurotransmitter receptors, which allow researchers to answer some unique questions about the action of neurotransmitters. Unfortunately, very few research centers have the equipment required to obtain the images or the special equipment needed to create the positron-emitting tracer molecules, which typically need to be produced on site.

Transcranial magnetic stimulation (TMS) is a noninvasive method that causes **depolarization** or **hyperpolarization** in neurons near the scalp. This method is not considered

psychophysiological because the independent variable is physiological, rather than the dependent. However, it does qualify as a neuroscience method because it deals with the function of the nervous system, and it can readily be combined with conventional psychophysiological methods. In TMS, a coil of wire is placed just above the participant's scalp. When electricity flows through the coil, it produces a magnetic field. This magnetic field travels through the skull and scalp and affects neurons near the surface of the brain. When the magnetic field is rapidly turned on and off, a current is induced in the neurons, leading to depolarization or hyperpolarization, depending on the number of magnetic field pulses. Single- or paired-pulse TMS depolarizes site-specific neurons in the cortex, causing them to fire. If this method is used over primary motor cortex, it can produce or block muscle activity, such as inducing a finger twitch or preventing someone from pressing a button. If used over primary visual cortex, it can produce sensations of flashes of light or impair visual processes. This has proved to be a valuable tool in studying the function and timing of specific processes such as the recognition of visual stimuli. Repetitive TMS produces effects that last longer than the initial stimulation. Depending on the intensity, coil orientation, and frequency, neural activity in the stimulated area may be either attenuated or amplified. Used in this manner, TMS is able to explore **neural plasticity**, which is the ability of connections between neurons to change. This has implications for treating psychological disorders as well as understanding long-term changes in neuronal excitability.

Peripheral Nervous System

The psychophysiological methods discussed above focus on the central nervous system. Considerable research has also focused on the **peripheral nervous system**. These methods

include skin conductance, cardiovascular responses, muscle activity, pupil diameter, eye blinks, and eye movements. Skin conductance, for example, measures the electrical conductance (the inverse of resistance) between two points on the skin, which varies with the level of moisture. Sweat glands are responsible for this moisture and are controlled by the **sympathetic nervous system (SNS)**. Increases in skin conductance can be associated with changes in psychological activity. For example, studying skin conductance allows a researcher to investigate whether psychopaths react to fearful pictures in a normal way. Skin conductance provides relatively poor temporal resolution, with the entire response typically taking several seconds to emerge and resolve. However, it is an easy way to measure SNS response to a variety of stimuli.

Cardiovascular measures include heart rate, heart rate variability, and blood pressure. The heart is innervated by the **parasympathetic nervous system (PNS)** and SNS. Input from the PNS decreases heart rate and contractile strength, whereas input from the SNS increases heart rate and contractile strength. Heart rate can easily be monitored using a minimum of two electrodes and is measured by counting the number of heartbeats in a given time period, such as one minute, or by assessing the time between successive heartbeats. Psychological activity can prompt increases and decreases in heart rate, often in less than a second, making heart rate a sensitive measure of cognition. Measures of heart rate variability are concerned with consistency in the time interval between heartbeats. Changes in heart rate variability are associated with stress as well as psychiatric conditions. Figure 3 is an example of an electrocardiogram, which is used to measure heart rate and heart rate variability. These cardiovascular measures allow researchers to monitor SNS and PNS reactivity to various stimuli or situations. For example, when an arachnophobe views pictures of spiders, does their

heart rate increase more than that of a person not afraid of spiders?

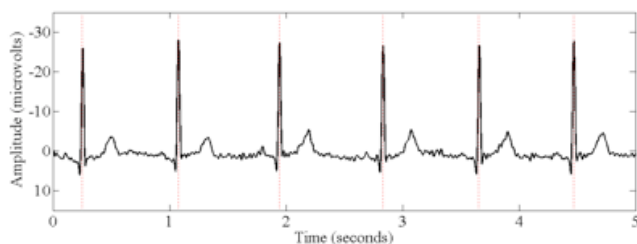


Figure 3. Example of electrocardiogram. The number of strong negative spikes in the output during a given period of time represents the heart rate, whereas the difference in the spacing between those strong negative spikes represents the heart rate variability.

Electromyography (EMG) measures electrical activity produced by skeletal muscles. Similar to EEG, EMG measures the voltage between two points. This technique can be used to determine when a participant first initiates muscle activity to engage in a motor response to a stimulus or the degree to which a participant begins to engage in an incorrect response (such as pressing the wrong button), even if it is never visibly executed. It has also been used in emotion research to identify activity in muscles that are used to produce smiles and frowns. Using EMG, it is possible to detect very small facial movements that are not observable from looking at the face. The temporal resolution of EMG is similar to that of EEG and MEG.

Valuable information can also be gleaned from eye blinks, eye movements, and pupil diameter. Eye blinks are most often assessed using EMG electrodes placed just below the eyelid, but electrical activity associated directly with eye blinks or eye movements can be measured with electrodes placed on the face near the eyes, because there is voltage across the entire eyeball. Another option for the measurement of eye movement is a camera used to record video of an eye. This video method is

particularly valuable when determination of absolute direction of gaze (not just change in direction of gaze) is of interest, such as when the eyes scan a picture. With the help of a calibration period in which a participant looks at multiple, known targets, eye position is then extracted from each video frame during the main task and compared with data from the calibration phase, allowing researchers to identify the sequence, direction, and duration of gaze fixations. For example, when viewing pleasant or unpleasant images, people spend different amounts of time looking at the most arousing parts. This, in turn, can vary as a function of psychopathology. Additionally, the diameter of a participant's pupil can be measured and recorded over time from the video record. As with heart rate, pupil diameter is controlled by competing inputs from the SNS and PNS. Pupil diameter is commonly used as an index of mental effort when performing a task.

When to Use What

As the reader, you may be wondering, how do I know what tool is right for a given question? Generally, there are no definitive answers. If you wanted to know the temperature in the morning, would you check your phone? Look outside to see how warm it looks? Ask your roommate what he or she is wearing today? Look to see what other people are wearing? There is not a single way to answer the question. The same is true for research questions. However, there are some guidelines that one can consider. For example, if you are interested in what brain structures are associated with cognitive control, you wouldn't use peripheral nervous system measures. A technique such as fMRI or PET might be more appropriate. If you are interested in how cognitive control unfolds over time, EEG or MEG would be a good choice. If you are interested in studying the bodily response to fear in

different groups of people, peripheral nervous system measures might be most appropriate. The key to deciding what method is most appropriate is properly defining the question that you are trying to answer. What aspects are most interesting? Do you care about identifying the most relevant brain structures? Temporal dynamics? Bodily responses? Then, it is important to think about the strengths and weaknesses of the different psychophysiological measures and pick one, or several, whose attributes work best for the question at hand. In fact, it is common to record several at once.

Conclusion

The outline of psychophysiological methods above provides a glimpse into the exciting techniques that are available to researchers studying a broad range of topics from clinical to social to cognitive psychology. Some of the most interesting psychophysiological studies use several methods, such as in sleep assessments or multimodal neuroimaging. Psychophysiological methods have applications outside of mainstream psychology in areas where psychological phenomena are central, such as economics, health-related decision making, and brain–computer interfaces. Examples of applications for each method are provided above, but this list is by no means exhaustive. Furthermore, the field is continually evolving, with new methods and new applications being developed. The wide variety of methods and applications provide virtually limitless possibilities for researchers.

Check Your Knowledge

To help you with your studying, we've included some practice

questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Blood-oxygen-level-dependent (BOLD)

The signal typically measured in fMRI that results from changes in the ratio of oxygenated hemoglobin to deoxygenated hemoglobin in the blood.

Central nervous system

The part of the nervous system that consists of the brain and spinal cord.

Deoxygenated hemoglobin

Hemoglobin not carrying oxygen.

Depolarization

A change in a cell's membrane potential, making the inside of the cell more positive and increasing the chance of an action potential.

Hemoglobin

The oxygen-carrying portion of a red blood cell.

Hyperpolarization

A change in a cell's membrane potential, making the inside of the cell more negative and decreasing the chance of an action potential.

Invasive Procedure

A procedure that involves the skin being broken or an instrument or chemical being introduced into a body cavity.

Lesions

Abnormalities in the tissue of an organism usually caused by disease or trauma.

Neural plasticity

The ability of synapses and neural pathways to change over time and adapt to changes in neural process, behavior, or environment.

Neuroscience methods

A research method that deals with the structure or function of the nervous system and brain.

Noninvasive procedure

A procedure that does not require the insertion of an instrument or chemical through the skin or into a body cavity.

Oxygenated hemoglobin

Hemoglobin carrying oxygen.

Parasympathetic nervous system (PNS)

One of the two major divisions of the autonomic nervous system, responsible for stimulation of “rest and digest” activities.

Peripheral nervous system

The part of the nervous system that is outside the brain and spinal cord.

Positron

A particle having the same mass and numerically equal but positive charge as an electron.

Psychophysiological methods

Any research method in which the dependent variable is a physiological measure and the independent variable is behavioral or mental (such as memory).

Spatial resolution

The degree to which one can separate a single object in space from another.

Sympathetic nervous system (SNS)

One of the two major divisions of the autonomic nervous system, responsible for stimulation of “fight or flight” activities.

Temporal resolution

The degree to which one can separate a single point in time from another.

Voltage

The difference in electric charge between two points.

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PSYC 100 VII

INTRODUCTION TO SENSATION AND PERCEPTION

20. Sensation and Perception

Original chapter by Adam John Privitera
adapted by the Queen's University
Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

The topics of sensation and perception are among the oldest and most important in all of psychology. People are equipped with senses such as sight, hearing and taste that help us to take in the world around us. Amazingly, our senses have the ability to convert real-world information into electrical information that can be processed by the brain. The way we interpret this information—our perceptions—is what leads to our experiences of the world. In this module, you will learn about the biological processes of sensation and how these can be combined to create perceptions.

Learning Objectives

- Differentiate the processes of sensation and perception.
- Explain the basic principles of sensation and perception.

- Describe the function of each of our senses.
- Outline the anatomy of the sense organs and their projections to the nervous system.
- Apply knowledge of sensation and perception to real world examples.
- Explain the consequences of multimodal perception.

Introduction

“Once I was hiking at Cape Lookout State Park in Tillamook, Oregon. After passing through a vibrantly colored, pleasantly scented, temperate rainforest, I arrived at a cliff overlooking the Pacific Ocean. I grabbed the cold metal railing near the edge and looked out at the sea. Below me, I could see a pod of sea lions swimming in the deep blue water. All around me I could smell the salt from the sea and the scent of wet, fallen leaves.”

This description of a single memory highlights the way a person's senses are so important to our experience of the world around us.

Before discussing each of our extraordinary senses individually, it is necessary to cover some basic concepts that apply to all of them. It is probably best to start with one very important distinction that can often be confusing: the difference between sensation and perception.

The *physical* process during which our sensory organs—those involved with



Our senses combine to create our perceptions of the world. [Image: Adam John Privitera, CC BY-NC-SA 4.0, <https://goo.gl/H2QaA8>]

hearing and taste, for example—respond to external stimuli is called **sensation**. Sensation happens when you eat noodles or feel the wind on your face or hear a car horn honking in the distance. During sensation, our sense organs are engaging in **transduction**, the conversion of one form of energy into another. Physical energy such as light or a sound wave is converted into a form of energy the brain can understand: electrical stimulation. After our brain receives the electrical signals, we make sense of all this stimulation and begin to appreciate the complex world around us. This *psychological* process—making sense of the stimuli—is called **perception**. It is during this process that you are able to *identify* a gas leak in your home or a song that reminds you of a specific afternoon spent with friends.

Regardless of whether we are talking about sight or taste or any of the individual senses, there are a number of basic principles that influence the way our sense organs work. The first of these influences is our ability to detect an external stimulus. Each sense organ—our eyes or tongue, for instance—requires a minimal amount of stimulation in order to detect a stimulus. This **absolute threshold** explains why you don't smell the perfume someone is wearing in a classroom unless they are somewhat close to you.

The way we measure absolute thresholds is by using a method called **signal detection**. This process involves presenting stimuli of varying intensities to a research participant in order to determine the level at which he or she can reliably detect stimulation in a given sense. During one type of hearing test, for example, a person listens to increasingly louder tones (starting from silence). This type of test is called *the method of limits*, and it is an effort to determine the point, or threshold, at which a person begins to hear a stimulus (see Additional Resources for a video demonstration). In the example of louder tones, the method of limits test is using *ascending trials*. Some method of limits

tests use *descending trials*, such as making a light grow dimmer until a person can no longer see it. Correctly indicating that a sound was heard is called a hit; failing to do so is called a miss. Additionally, indicating that a sound was heard when one wasn't played is called a *false alarm*, and correctly identifying when a sound wasn't played is a *correct rejection*.

Through these and other studies, we have been able to gain an understanding of just how remarkable our senses are. For example, the human eye is capable of detecting candlelight from 30 miles away in the dark. We are also capable of hearing the ticking of a watch in a quiet environment from 20 feet away. If you think that's amazing, I encourage you to read more about the extreme sensory capabilities of nonhuman animals; many animals possess what we would consider super-human abilities.

A similar principle to the absolute threshold discussed above underlies our ability to detect the difference between two stimuli of different intensities. The **differential threshold**, or **just noticeable difference (JND)**, for each sense has been studied using similar methods to signal detection. To illustrate, find a friend and a few objects of known weight (you'll need objects that weigh 1, 2, 10 and 11 lbs.—or in metric terms: 1, 2, 5 and 5.5 kg). Have your friend hold the lightest object (1 lb. or 1 kg). Then, replace this object with the next heaviest and ask him or her to tell you which one weighs more. Reliably, your friend will say the second object every single time. It's extremely easy to tell the difference when something weighs double what another weighs! However, it is not so easy when the difference is a smaller percentage of the overall weight. It will be much harder for your friend to reliably tell the difference between 10 and 11 lbs. (or 5 versus 5.5 kg) than it is for 1 and 2 lbs. This phenomenon is called **Weber's Law**, and it is the idea that bigger stimuli require larger differences to be noticed.

Crossing into the world of perception, it is clear that our experience influences how our brain processes things. You

have tasted food that you like and food that you don't like. There are some bands you enjoy and others you can't stand. However, during the time you first eat something or hear a band, you process those stimuli using **bottom-up processing**. This is when we build up to perception from the individual pieces. Sometimes, though, stimuli we've experienced in our past will influence how we process new ones. This is called **top-down processing**. The best way to illustrate these two concepts is with our ability to read. Read the following quote out loud



Figure 1. An example of stimuli processing.

Notice anything odd while you were reading the text in the triangle? Did you notice the second “the”? If not, it's likely because you were reading this from a top-down approach. Having a second “the” doesn't make sense. We know this. Our brain knows this and doesn't expect there to be a second one, so we have a tendency to skip right over it. In other words,

your past experience has changed the way you perceive the writing in the triangle! A beginning reader—one who is using a bottom-up approach by carefully attending to each piece—would be less likely to make this error.

Finally, it should be noted that when we experience a sensory stimulus that doesn't change, we stop paying attention to it. This is why we don't feel the weight of our clothing, hear the hum of a projector in a lecture hall, or see all the tiny scratches on the lenses of our glasses. When a stimulus is constant and unchanging, we experience **sensory adaptation**. This occurs because if a stimulus does not change, our receptors quit responding to it. A great example of this occurs when we leave the radio on in our car after we park it at home for the night. When we listen to the radio on the way home from work the volume seems reasonable. However, the next morning when we start the car, we might be startled by how loud the radio is. We don't remember it being that loud last night. What happened? We adapted to the constant stimulus (the radio volume) over the course of the previous day and increased the volume at various times.

Now that we have introduced some basic sensory principles, let us take on each one of our fascinating senses individually.

Vision

How vision works

Vision is a tricky matter. When we see a pizza, a feather, or a hammer, we are actually seeing light bounce off that object and into our eye. Light enters the eye through the pupil, a tiny opening behind the cornea. The pupil regulates the amount of light entering the eye by contracting (getting smaller) in bright light and dilating (getting larger) in dimmer light. Once

past the pupil, light passes through the lens, which focuses an image on a thin layer of cells in the back of the eye, called the **retina**.

Because we have two eyes in different locations, the image focused on each retina is from a slightly different angle (**binocular disparity**), providing us with our perception of 3D space (**binocular vision**). You can appreciate this by holding a pen in your hand, extending your arm in front of your face, and looking at the pen while closing each eye in turn. Pay attention to the apparent position of the pen relative to objects in the background. Depending on which eye is open, the pen appears to jump back and forth! This is how video game manufacturers create the perception of 3D without special glasses; two slightly different images are presented on top of one another.

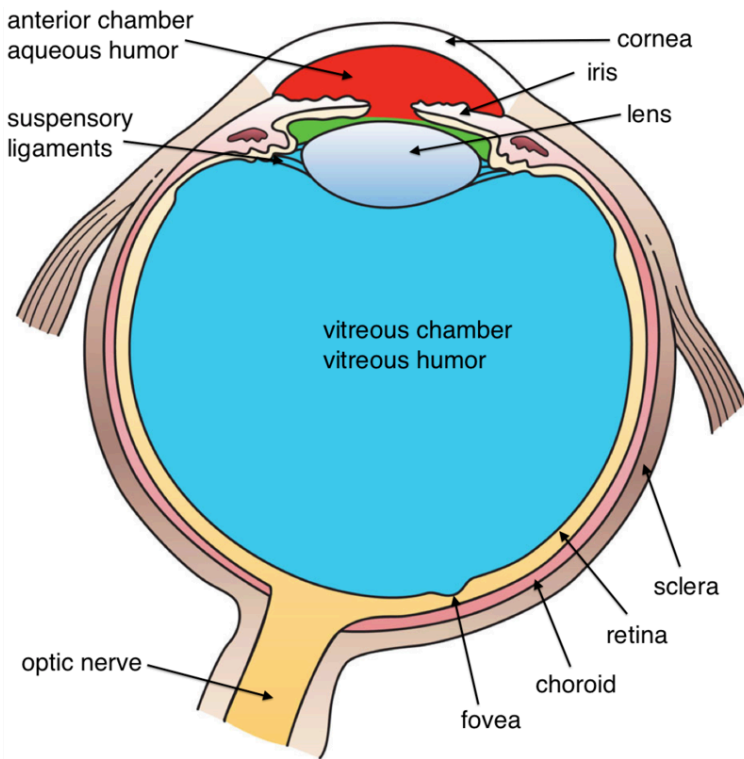


Figure 2. Diagram of the human eye. Notice the Retina, labeled here: this is the location of the Cones and Rods in the eye. [Image: Holly Fischer, <https://goo.gl/ozuGOQ>, CC BY 3.0, <https://goo.gl/TSIsIq>]

It is in the retina that light is transduced, or converted into electrical signals, by specialized cells called photoreceptors. The retina contains two main kinds of photoreceptors: **rods** and **cones**. Rods are primarily responsible for our ability to see in dim light conditions, such as during the night. Cones, on the other hand, provide us with the ability to see color and fine detail when the light is brighter. Rods and cones differ in their distribution across the retina, with the highest concentration of cones found in the fovea (the

central region of focus), and rods dominating the periphery (see Figure 2). The difference in distribution can explain why looking directly at a dim star in the sky makes it seem to disappear; there aren't enough rods to process the dim light!

Next, the electrical signal is sent through a layer of cells in the retina, eventually traveling down the optic nerve. After passing through the thalamus, this signal makes it to the **primary visual cortex**, where information about light orientation and movement begin to come together (Hubel & Wiesel, 1962). Information is then sent to a variety of different areas of the cortex for more complex processing. Some of these cortical regions are fairly specialized—for example, for processing faces (fusiform face area) and body parts (extrastriate body area). Damage to these areas of the cortex can potentially result in a specific kind of **agnosia**, whereby a person loses the ability to perceive visual stimuli. A great example of this is illustrated in the writing of famous neurologist Dr. Oliver Sacks; he experienced *prosopagnosia*, the inability to recognize faces. These specialized regions for visual recognition comprise the **ventral pathway** (also called the “what” pathway). Other areas involved in processing location and movement make up the **dorsal pathway** (also called the “where” pathway). Together, these pathways process a large amount of information about visual stimuli (Goodale & Milner, 1992). Phenomena we often refer to as optical illusions provide misleading information to these “higher” areas of visual processing.

Dark and light adaptation

Humans have the ability to adapt to changes in light conditions. As mentioned before, rods are primarily involved in our ability to see in dim light. They are the photoreceptors responsible for allowing us to see in a dark room. You might

notice that this night vision ability takes around 10 minutes to turn on, a process called **dark adaptation**. This is because our rods become bleached in normal light conditions and require time to recover. We experience the opposite effect when we leave a dark movie theatre and head out into the afternoon sun. During **light adaptation**, a large number of rods and cones are bleached at once, causing us to be blinded for a few seconds. Light adaptation happens almost instantly compared with dark adaptation. Interestingly, some people think pirates wore a patch over one eye in order to keep it adapted to the dark while the other was adapted to the light. If you want to turn on a light without losing your night vision, don't worry about wearing an eye patch, just use a red light; this wavelength doesn't bleach your rods.

Color vision



Figure 3. Stare at the center of the Canadian flag for fifteen seconds. Then, shift your eyes away to a white wall or blank piece of paper. You should see an "after image" in a different color scheme.

Our cones allow us to see details in normal light conditions, as well as color. We have cones that respond *preferentially*, not exclusively, for red, green and blue (Svaetichin, 1955). This **trichromatic theory** is not new; it dates back to the early 19th century (Young, 1802; Von Helmholtz, 1867).

This theory, however, does not explain the odd effect that occurs when we look at a white wall after staring at a picture for around 30 seconds. Try this: stare at the image of the flag in Figure 3 for 30 seconds and then immediately look at a sheet of white paper or a wall. According to the trichromatic theory of color vision, you should see white when you do that. Is that

what you experienced? As you can see, the trichromatic theory doesn't explain the *afterimage* you just witnessed. This is where the **opponent-process theory** comes in (Hering, 1920). This theory states that our cones send information to *retinal ganglion cells* that respond to *pairs* of colors (red-green, blue-yellow, black-white). These specialized cells take information from the cones and compute the difference between the two colors—a process that explains why we cannot see reddish-green or bluish-yellow, as well as why we see afterimages. Color deficient vision can result from issues with the cones or retinal ganglion cells involved in color vision.

Hearing (Audition)

Some of the most well-known celebrities and top earners in the world are musicians. Our worship of musicians may seem silly when you consider that all they are doing is vibrating the air a certain way to create **sound waves**, the physical stimulus for **audition**.

People are capable of getting a large amount of information from the basic qualities of sound waves. The *amplitude* (or intensity) of a sound wave codes for the loudness of a stimulus; higher amplitude sound waves result in louder sounds. The *pitch* of a stimulus is coded in the *frequency* of a sound wave; higher frequency sounds are higher pitched. We can also gauge the quality, or *timbre*, of a sound by the complexity of the sound wave. This allows us to tell the difference between bright and dull sounds as well as natural and synthesized instruments (Välimäki & Takala, 1996).

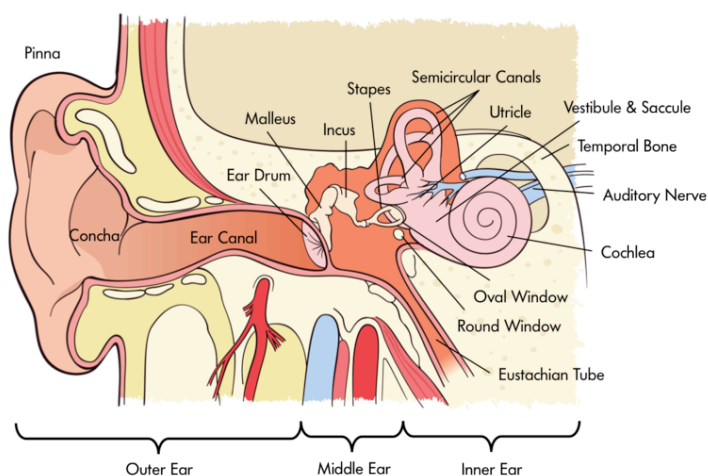


Figure 4. Diagram of the human ear. Notice the Cochlea labeled here: it is the location of the auditory Hair Cells that are tonotopically organized.

In order for us to sense sound waves from our environment they must reach our inner ear. Lucky for us, we have evolved tools that allow those waves to be funneled and amplified during this journey. Initially, sound waves are funneled by your **pinna** (the external part of your ear that you can actually see) into your **auditory canal** (the hole you stick Q-tips into despite the box advising against it). During their journey, sound waves eventually reach a thin, stretched membrane called the **tympanic membrane** (eardrum), which vibrates against the three smallest bones in the body—the malleus (hammer), the incus (anvil), and the stapes (stirrup)—collectively called the **ossicles**. Both the tympanic membrane and the ossicles amplify the sound waves before they enter the fluid-filled **cochlea**, a snail-shell-like bone structure containing **auditory hair cells** arranged on the basilar membrane (see Figure 4) according to the frequency they

respond to (called tonotopic organization). Depending on age, humans can normally detect sounds between 20 Hz and 20 kHz. It is inside the cochlea that sound waves are converted into an electrical message.

Because we have an ear on each side of our head, we are capable of localizing sound in 3D space pretty well (in the same way that having two eyes produces 3D vision). Have you ever dropped something on the floor without seeing where it went? Did you notice that you were somewhat capable of locating this object based on the sound it made when it hit the ground? We can reliably locate something based on which ear receives the sound first. What about the height of a sound? If both ears receive a sound at the same time, how are we capable of localizing sound vertically? Research in cats (**Populin & Yin, 1998**) and humans (**Middlebrooks & Green, 1991**) has pointed to differences in the quality of sound waves depending on vertical positioning.

After being processed by auditory hair cells, electrical signals are sent through the *cochlear nerve* (a division of the vestibulocochlear nerve) to the thalamus, and then the **primary auditory cortex** of the temporal lobe. Interestingly, the tonotopic organization of the cochlea is maintained in this area of the cortex (**Merzenich, Knight, & Roth, 1975; Romani, Williamson, & Kaufman, 1982**). However, the role of the primary auditory cortex in processing the wide range of features of sound is still being explored (**Walker, Bizley, & Schnupp, 2011**).

Balance and the vestibular system

The inner ear isn't only involved in hearing; it's also associated with our ability to balance and detect where we are in space. The **vestibular system** is comprised of three semicircular canals—fluid-filled bone structures containing cells that respond to changes in the head's orientation in space.

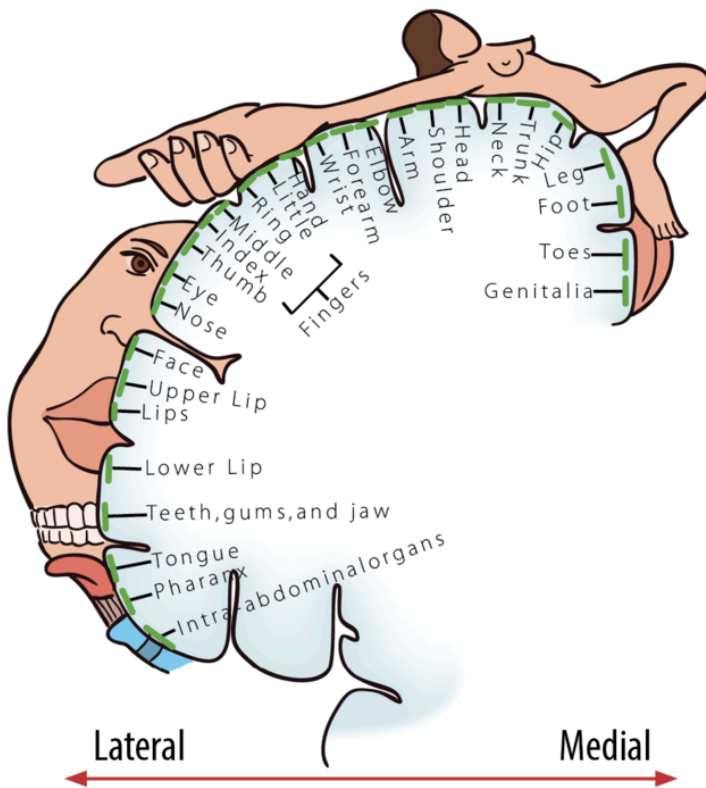
Information from the vestibular system is sent through the vestibular nerve (the other division of the vestibulocochlear nerve) to muscles involved in the movement of our eyes, neck, and other parts of our body. This information allows us to maintain our gaze on an object while we are in motion. Disturbances in the vestibular system can result in issues with balance, including vertigo.

Touch

Who doesn't love the softness of an old t-shirt or the smoothness of a clean shave? Who actually enjoys having sand in their swimsuit? Our skin, the body's largest organ, provides us with all sorts of information, such as whether something is smooth or bumpy, hot or cold, or even if it's painful. **Somatosensation**—which includes our ability to sense touch, temperature and pain—transduces physical stimuli, such as fuzzy velvet or scalding water, into electrical potentials that can be processed by the brain.

Tactile sensation

Tactile stimuli—those that are associated with texture—are transduced by special receptors in the skin called **mechanoreceptors**. Just like photoreceptors in the eye and auditory hair cells in the ear, these allow for the conversion of one kind of energy into a form the brain can understand.



Somatosensory Map

Figure 5. A drawing of the somatosensory cortex in the brain and the areas in the human body that correspond to it – they are drawn in proportion to the most sensitive or the most innervated parts of the body.

After tactile stimuli are converted by mechanoreceptors, information is sent through the thalamus to the **primary somatosensory cortex** for further processing. This region of the cortex is organized in a **somatotopic map** where different regions are sized based on the sensitivity of specific parts on

the opposite side of the body (**Penfield & Rasmussen, 1950**). Put simply, various areas of the skin, such as lips and fingertips, are more sensitive than others, such as shoulders or ankles. This sensitivity can be represented with the distorted proportions of the human body shown in Figure 5.

Pain

Most people, if asked, would love to get rid of pain (**nociception**), because the sensation is very unpleasant and doesn't appear to have obvious value. But the perception of pain is our body's way of sending us a signal that something is wrong and needs our attention. Without pain, how would we know when we are accidentally touching a hot stove, or that we should rest a strained arm after a hard workout?

Phantom limbs

Records of people experiencing **phantom limbs** after amputations have been around for centuries (**Mitchell, 1871**). As the name suggests, people with a phantom limb have the sensations such as itching seemingly coming from their missing limb. A phantom limb can also involve **phantom limb pain**, sometimes described as the muscles of the missing limb uncomfortably clenching. While the mechanisms underlying these phenomena are not fully understood, there is evidence to support that the damaged nerves from the amputation site are still sending information to the brain (**Weinstein, 1998**) and that the brain is reacting to this information (**Ramachandran & Rogers-Ramachandran, 2000**). There is an interesting treatment for the alleviation of phantom limb pain that works by tricking the brain, using a special mirror box to create a

visual representation of the missing limb. The technique allows the patient to manipulate this representation into a more comfortable position (Ramachandran & Rogers-Ramachandran, 1996).

Smell and Taste: The Chemical Senses

The two most underappreciated senses can be lumped into the broad category of **chemical senses**. Both **olfaction** (smell) and **gustation** (taste) require the transduction of chemical stimuli into electrical potentials. I say these senses are underappreciated because most people would give up either one of these if they were forced to give up a sense. While this may not shock a lot of readers, take into consideration how much money people spend on the perfume industry annually (\$29 billion US Dollars). Many of us pay a lot more for a favorite brand of food because we prefer the taste. Clearly, we humans care about our chemical senses.

Olfaction (smell)

Unlike any of the other senses discussed so far, the receptors involved in our perception of both smell and taste bind directly with the stimuli they transduce. **Odorants** in our environment, very often mixtures of them, bind with olfactory receptors found in the **olfactory epithelium**. The binding of odorants to receptors is thought to be similar to how a lock and key operates, with different odorants binding to different specialized receptors based on their shape. However, the **shape theory of olfaction** isn't universally accepted and alternative theories exist, including one that argues that the vibrations of odorant molecules correspond to their subjective

smells (Turin, 1996). Regardless of how odorants bind with receptors, the result is a pattern of neural activity. It is thought that our memories of these patterns of activity underlie our subjective experience of smell (Shepherd, 2005). Interestingly, because olfactory receptors send projections to the brain through the *cribriform plate* of the skull, head trauma has the potential to cause **anosmia**, due to the severing of these connections. If you are in a line of work where you constantly experience head trauma (e.g. professional boxer) and you develop anosmia, don't worry—your sense of smell will probably come back (Sumner, 1964).

Gustation (taste)

Taste works in a similar fashion to smell, only with receptors found in the taste buds of the tongue, called **taste receptor cells**. To clarify a common misconception, taste buds are not the bumps on your tongue (papillae), but are located in small divots around these bumps. These receptors also respond to chemicals from the outside environment, except these chemicals, called **tastants**, are contained in the foods we eat. The binding of these chemicals with taste receptor cells results in our perception of the five basic tastes: sweet, sour, bitter, salty and umami



Ghost Pepper, also known as Bhut Jolokia is one of the hottest peppers in the world, it's 10 times hotter than a habanero, and 400 times hotter than tabasco sauce. What do you think would happen to your taste receptor cells if you took a bite out of this little guy?
[Image: Richard Elzey,
<https://goo.gl/suJHNg>, CC BY 2.0,
<https://goo.gl/9uSnqN>]

(savory)—although some scientists argue that there are more (Stewart et al., 2010). Researchers used to think these tastes formed the basis for a map-like organization of the tongue; there was even a clever rationale for the concept, about how the back of the tongue sensed bitter so we would know to spit out poisons, and the front of the tongue sensed sweet so we could identify high-energy foods. However, we now know that all areas of the tongue with taste receptor cells are capable of responding to every taste (Chandrashekar, Hoon, Ryba, & Zuker, 2006).

During the process of eating we are not limited to our sense of taste alone. While we are chewing, food odorants are forced back up to areas that contain olfactory receptors. This combination of taste and smell gives us the perception of **flavor**. If you have doubts about the interaction between these two senses, I encourage you to think back to consider how the flavors of your favorite foods are impacted when you have a cold; everything is pretty bland and boring, right?

Putting it all Together: Multimodal Perception

Though we have spent the majority of this module covering the senses individually, our real-world experience is most often multimodal, involving combinations of our senses into one perceptual experience. This should be clear after reading the description of walking through the forest at the beginning of the module; it was the combination of senses that allowed for that experience. It shouldn't shock you to find out that at some point information from each of our senses becomes integrated. Information from one sense has the potential to influence how we perceive information from another, a process called **multimodal perception**.

Interestingly, we actually respond more strongly to multimodal stimuli compared to the sum of each single modality together, an effect called the **superadditive effect of multisensory integration**. This can explain how you're still able to understand what friends are saying to you at a loud concert, as long as you are able to get visual cues from watching them speak. If you were having a quiet conversation at a café, you likely wouldn't need these additional cues. In fact, the **principle of inverse effectiveness** states that you are *less* likely to benefit from additional cues from other modalities if the initial unimodal stimulus is strong enough (Stein & Meredith, 1993).

Because we are able to process multimodal sensory stimuli, and the results of those processes are qualitatively different from those of unimodal stimuli, it's a fair assumption that the brain is doing something qualitatively different when they're being processed. There has been a growing body of evidence since the mid-90's on the neural correlates of multimodal perception. For example, neurons that respond to both visual and auditory stimuli have been identified in the *superior temporal sulcus* (Calvert, Hansen, Iversen, & Brammer, 2001). Additionally, multimodal "what" and "where" pathways have been proposed for auditory and tactile stimuli (Renier et al., 2009). We aren't limited to reading about these regions of the brain and what they do; we can experience them with a few interesting examples including the McGurk Effect and Double Flash Illusion.



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To experience the Double Flash illusion, please see this demo from Dr. Ladan Shams' lab at UCLA: <https://shamslab.psych.ucla.edu/demos/>

Conclusion

Our impressive sensory abilities allow us to experience the most enjoyable and most miserable experiences, as well as everything in between. Our eyes, ears, nose, tongue and skin provide an interface for the brain to interact with the world around us. While there is simplicity in covering each sensory modality independently, we are organisms that have evolved the ability to process multiple modalities as a unified experience.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Absolute threshold

The smallest amount of stimulation needed for detection by a sense.

Agnosia

Loss of the ability to perceive stimuli.

Anosmia

Loss of the ability to smell.

Audition

Ability to process auditory stimuli. Also called hearing.

Auditory canal

Tube running from the outer ear to the middle ear.

Auditory hair cells

Receptors in the cochlea that transduce sound into electrical potentials.

Binocular disparity

Difference in images processed by the left and right eyes.

Binocular vision

Our ability to perceive 3D and depth because of the

difference between the images on each of our retinas.

Bottom-up processing

Building up to perceptual experience from individual pieces.

Chemical senses

Our ability to process the environmental stimuli of smell and taste.

Cochlea

Spiral bone structure in the inner ear containing auditory hair cells.

Cones

Photoreceptors of the retina sensitive to color. Located primarily in the fovea.

Dark adaptation

Adjustment of eye to low levels of light.

Differential threshold

The smallest difference needed in order to differentiate two stimuli. (See Just Noticeable Difference (JND))

Dorsal pathway

Pathway of visual processing. The “where” pathway.

Flavor

The combination of smell and taste.

Gustation

Ability to process gustatory stimuli. Also called taste.

Just noticeable difference (JND)

The smallest difference needed in order to differentiate two stimuli. (see Differential Threshold)

Light adaptation

Adjustment of eye to high levels of light.

Mechanoreceptors

Mechanical sensory receptors in the skin that response to tactile stimulation.

Multimodal perception

The effects that concurrent stimulation in more than one sensory modality has on the perception of events and objects in the world.

Nociception

Our ability to sense pain.

Odorants

Chemicals transduced by olfactory receptors.

Olfaction

Ability to process olfactory stimuli. Also called smell.

Olfactory epithelium

Organ containing olfactory receptors.

Opponent-process theory

Theory proposing color vision as influenced by cells responsive to pairs of colors.

Ossicles

A collection of three small bones in the middle ear that vibrate against the tympanic membrane.

Perception

The psychological process of interpreting sensory information.

Phantom limb

The perception that a missing limb still exists.

Phantom limb pain

Pain in a limb that no longer exists.

Pinna

Outermost portion of the ear.

Primary auditory cortex

Area of the cortex involved in processing auditory stimuli.

Primary somatosensory cortex

Area of the cortex involved in processing somatosensory stimuli.

Primary visual cortex

Area of the cortex involved in processing visual stimuli.

Principle of inverse effectiveness

The finding that, in general, for a multimodal stimulus, if the response to each unimodal component (on its own) is weak, then the opportunity for multisensory enhancement is very large. However, if one component—by itself—is sufficient to evoke a strong response, then the effect on the response gained by simultaneously processing the other components of the stimulus will be relatively small.

Retina

Cell layer in the back of the eye containing photoreceptors.

Rods

Photoreceptors of the retina sensitive to low levels of light. Located around the fovea.

Sensation

The physical processing of environmental stimuli by the sense organs.

Sensory adaptation

Decrease in sensitivity of a receptor to a stimulus after constant stimulation.

Shape theory of olfaction

Theory proposing that odorants of different size and shape correspond to different smells.

Signal detection

Method for studying the ability to correctly identify sensory stimuli.

Somatosensation

Ability to sense touch, pain and temperature.

Somatotopic map

Organization of the primary somatosensory cortex maintaining a representation of the arrangement of the body.

Sound waves

Changes in air pressure. The physical stimulus for audition.

Superadditive effect of multisensory integration

The finding that responses to multimodal stimuli are typically greater than the sum of the independent responses to each unimodal component if it were presented on its own.

Tastants

Chemicals transduced by taste receptor cells.

Taste receptor cells

Receptors that transduce gustatory information.

Top-down processing

Experience influencing the perception of stimuli.

Transduction

The conversion of one form of energy into another.

Trichromatic theory

Theory proposing color vision as influenced by three different cones responding preferentially to red, green and blue.

Tympanic membrane

Thin, stretched membrane in the middle ear that vibrates in response to sound. Also called the eardrum.

Ventral pathway

Pathway of visual processing. The “what” pathway.

Vestibular system

Parts of the inner ear involved in balance.

Weber’s law

States that just noticeable difference is proportional to the magnitude of the initial stimulus.

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21. Hearing

Original chapter by Andrew J. Oxenham
adapted by the Queen's University
Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

Hearing allows us to perceive the world of acoustic vibrations all around us, and provides us with our most important channels of communication. This module reviews the basic mechanisms of hearing, beginning with the anatomy and physiology of the ear and a brief review of the auditory pathways up to the auditory cortex. An outline of the basic perceptual attributes of sound, including loudness, pitch, and timbre, is followed by a review of the principles of tonotopic organization, established in the cochlea. An overview of masking and frequency selectivity is followed by a review of the perception and neural mechanisms underlying spatial hearing. Finally, an overview is provided of auditory scene analysis, which tackles the important question of how the auditory system is able to make sense of the complex mixtures of sounds that are encountered in everyday acoustic environments.

Learning Objectives

- Describe the basic auditory attributes of sound.
- Describe the structure and general function of the auditory pathways from the outer ear to the auditory cortex.
- Discuss ways in which we are able to locate sounds in space.
- Describe various acoustic cues that contribute to our ability to perceptually segregate simultaneously arriving sounds.

Introduction

Hearing forms a crucial part of our everyday life. Most of our communication with others, via speech or music, reaches us through the ears. Indeed, a saying, often attributed to Helen Keller, is that blindness separates us from things, but deafness separates us from people. The ears respond to acoustic information, or sound—tiny and rapid variations in air pressure. Sound waves travel from the source and produce pressure variations in the listener's ear canals, causing the eardrums (or tympanic membranes) to vibrate. This module provides an overview of the events that follow, which convert these simple mechanical



Hearing provides us with our most important connection to the people around us. [Image: Bindaas Madhavi, <https://goo.gl/Sv6TtR>, CC BY-NC-ND 2.0, <https://goo.gl/62XJAl>]

vibrations into our rich experience known as hearing, or auditory perception.

Perceptual Attributes of Sound

There are many ways to describe a sound, but the perceptual attributes of a sound can typically be divided into three main categories—namely, loudness, pitch, and timbre. Although all three refer to perception, and not to the physical sounds themselves, they are strongly related to various physical variables.

Loudness

The most direct physical correlate of loudness is sound intensity (or sound pressure) measured close to the eardrum. However, many other factors also influence the loudness of a sound, including its frequency content, its duration, and the context in which it is presented. Some of the earliest psychophysical studies of auditory perception, going back more than a century, were aimed at examining the relationships between perceived loudness, the physical sound intensity, and the just-noticeable differences in loudness (**Fechner, 1860; Stevens, 1957**). A great deal of time and effort has been spent refining various measurement methods. These methods involve techniques such as magnitude estimation, where a series of sounds (often sinusoids, or pure tones of single frequency) are presented sequentially at different sound levels, and subjects are asked to assign numbers to each tone, corresponding to the perceived loudness. Other studies have examined how loudness changes as a function of the frequency of a tone, resulting in the international standard iso-

loudness-level contours (**ISO, 2003**), which are used in many areas of industry to assess noise and annoyance issues. Such studies have led to the development of computational models that are designed to predict the loudness of arbitrary sounds (e.g., **Moore, Glasberg, & Baer, 1997**).

Pitch



Pitch is crucial to our perception and understanding of music and language. [Image: xroper7, <https://goo.gl/1E4sJY>, CC BY-NC 2.0, <https://goo.gl/tgFydH>]

Pitch plays a crucial role in acoustic communication. Pitch variations over time provide the basis of melody for most types of music; pitch contours in speech provide us with important prosodic information in non-tone languages, such as English, and help define the meaning of words in tone languages, such as Mandarin Chinese. Pitch is essentially the perceptual correlate of waveform periodicity, or

repetition rate: The faster a waveform repeats over time, the higher is its perceived pitch. The most common pitch-evoking sounds are known as harmonic complex tones. They are complex because they consist of more than one frequency, and they are harmonic because the frequencies are all integer multiples of a common fundamental frequency (F_0). For instance, a harmonic complex tone with a F_0 of 100 Hz would also contain energy at frequencies of 200, 300, 400 Hz, and so on. These higher frequencies are known as harmonics or overtones, and they also play an important role in determining the pitch of a sound. In fact, even if the energy at the F_0 is

absent or masked, we generally still perceive the remaining sound to have a pitch corresponding to the F0. This phenomenon is known as the “pitch of the missing fundamental,” and it has played an important role in the formation of theories and models about pitch (**de Cheveigné, 2005**). We hear pitch with sufficient accuracy to perceive melodies over a range of F0s from about 30 Hz (**Pressnitzer, Patterson, & Krumbholz, 2001**) up to about 4–5 kHz (**Attneave & Olson, 1971; Oxenham, Micheyl, Keebler, Loper, & Santurette, 2011**). This range also corresponds quite well to the range covered by musical instruments; for instance, the modern grand piano has notes that extend from 27.5 Hz to 4,186 Hz. We are able to discriminate changes in frequency above 5,000 Hz, but we are no longer very accurate in recognizing melodies or judging musical intervals.

Timbre

Timbre refers to the quality of sound, and is often described using words such as bright, dull, harsh, and hollow. Technically, timbre includes anything that allows us to distinguish two sounds that have the same loudness, pitch, and duration. For instance, a violin and a piano playing the same note sound very different, based on their sound quality or timbre.

An important aspect of timbre is the spectral content of a sound. Sounds with more high-frequency energy tend to sound brighter, tinnier, or harsher than sounds with more low-frequency content, which might be described as deep, rich, or dull. Other important aspects of timbre include the temporal envelope (or outline) of the sound, especially how it begins and ends. For instance, a piano has a rapid onset, or attack, produced by the hammer striking the string, whereas the attack of a clarinet note can be much more gradual. Artificially changing the onset of a piano note by, for instance, playing

a recording backwards, can dramatically alter its character so that it is no longer recognizable as a piano note. In general, the overall spectral content and the temporal envelope can provide a good first approximation to any sound, but it turns out that subtle changes in the spectrum over time (or spectro-temporal variations) are crucial in creating plausible imitations of natural musical instruments (Risset & Wessel, 1999).

An Overview of the Auditory System

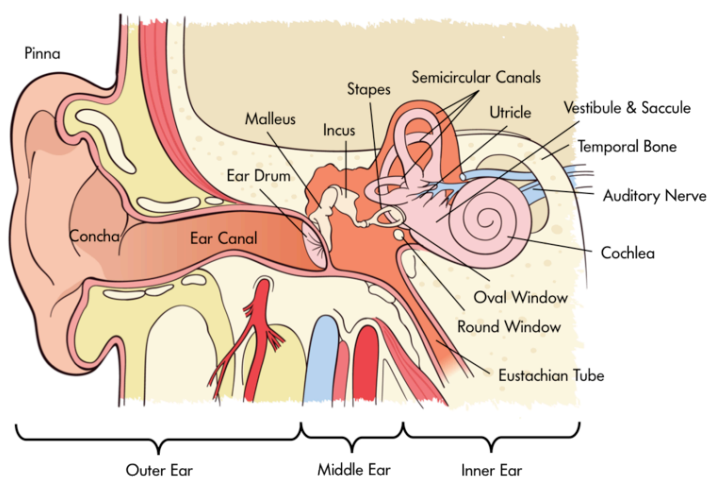


Figure 4. Diagram of the human ear. Notice the Cochlea labeled here: it is the location of the auditory Hair Cells that are tonotopically organized.

Our auditory perception depends on how sound is processed through the ear. The ear can be divided into three main parts—the outer, middle, and inner ear (see Figure 1). The outer ear consists of the **pinna** (the visible part of the ear, with all its unique folds and bumps), the ear canal (or auditory meatus),

and the **tympanic membrane**. Of course, most of us have two functioning ears, which turn out to be particularly useful when we are trying to figure out where a sound is coming from. As discussed below in the section on spatial hearing, our brain can compare the subtle differences in the signals at the two ears to localize sounds in space. However, this trick does not always help: for instance, a sound directly in front or directly behind you will not produce a difference between the ears. In these cases, the filtering produced by the pinnae helps us localize sounds and resolve potential front-back and up-down confusions. More generally, the folds and bumps of the pinna produce distinct peaks and dips in the frequency response that depend on the location of the sound source. The brain then learns to associate certain patterns of spectral peaks and dips with certain spatial locations. Interestingly, this learned association remains malleable, or plastic, even in adulthood. For instance, a study that altered the pinnae using molds found that people could learn to use their “new” ears accurately within a matter of a few weeks (**Hofman, Van Riswick, & Van Opstal, 1998**). Because of the small size of the pinna, these kinds of acoustic cues are only found at high frequencies, above about 2 kHz. At lower frequencies, the sound is basically unchanged whether it comes from above, in front, or below. The ear canal itself is a tube that helps to amplify sound in the region from about 1 to 4 kHz—a region particularly important for speech communication.

The middle ear consists of an air-filled cavity, which contains the middle-ear bones, known as the incus, malleus, and stapes, or anvil, hammer, and stirrup, because of their respective shapes. They have the distinction of being the smallest bones in the body. Their primary function is to transmit the vibrations from the tympanic membrane to the oval window of the cochlea and, via a form of lever action, to better match the impedance of the air surrounding the tympanic membrane with that of the fluid within the cochlea.

The inner ear includes the cochlea, encased in the temporal bone of the skull, in which the mechanical vibrations of sound are transduced into neural signals that are processed by the brain. The **cochlea** is a spiral-shaped structure that is filled with fluid. Along the length of the spiral runs the basilar membrane, which vibrates in response to the pressure differences produced by vibrations of the oval window. Sitting on the basilar membrane is the organ of Corti, which runs the entire length of the basilar membrane from the base (by the oval window) to the apex (the “tip” of the spiral). The organ of Corti includes three rows of outer hair cells and one row of inner hair cells. The hair cells sense the vibrations by way of their tiny hairs, or stereocilia. The outer hair cells seem to function to mechanically amplify the sound-induced vibrations, whereas the inner hair cells form synapses with the auditory nerve and transduce those vibrations into action potentials, or neural spikes, which are transmitted along the auditory nerve to higher centers of the auditory pathways.

One of the most important principles of hearing—frequency analysis—is established in the cochlea. In a way, the action of the cochlea can be likened to that of a prism: the many frequencies that make up a complex sound are broken down into their constituent frequencies, with low frequencies creating maximal basilar-membrane vibrations near the apex of the cochlea and high frequencies creating maximal basilar-membrane vibrations nearer the base of the cochlea. This decomposition of sound into its constituent frequencies, and the frequency-to-place mapping, or “tonotopic” representation, is a major organizational principle of the auditory system, and is maintained in the neural representation of sounds all the way from the cochlea to the primary auditory cortex. The decomposition of sound into its constituent frequency components is part of what allows us to hear more than one sound at a time. In addition to representing frequency by place of excitation within the

cochlea, frequencies are also represented by the timing of spikes within the auditory nerve. This property, known as “phase locking,” is crucial in comparing time-of-arrival differences of waveforms between the two ears (see the section on spatial hearing, below).

Unlike vision, where the primary visual cortex (or V1) is considered an early stage of processing, auditory signals go through many stages of processing before they reach the primary auditory cortex, located in the temporal lobe. Although we have a fairly good understanding of the electromechanical properties of the cochlea and its various structures, our understanding of the processing accomplished by higher stages of the auditory pathways remains somewhat sketchy. With the possible exception of spatial localization and neurons tuned to certain locations in space (**Harper & McAlpine, 2004; Knudsen & Konishi, 1978**), there is very little consensus on the how, what, and where of auditory feature extraction and representation. There is evidence for a “pitch center” in the auditory cortex from both human neuroimaging studies (e.g., **Griffiths, Buchel, Frackowiak, & Patterson, 1998; Penagos, Melcher, & Oxenham, 2004**) and single-unit physiology studies (**Bendor & Wang, 2005**), but even here there remain some questions regarding whether a single area of cortex is responsible for coding single features, such as pitch, or whether the code is more distributed (**Walker, Bizley, King, & Schnupp, 2011**).

Audibility, Masking, and Frequency Selectivity

Overall, the human cochlea provides us with hearing over a very wide range of frequencies. Young people with normal hearing are able to perceive sounds with frequencies ranging

from about 20 Hz all the way up to 20 kHz. The range of intensities we can perceive is also impressive: the quietest sounds we can hear in the medium-frequency range (between about 1 and 4 kHz) have a sound intensity that is about a factor of 1,000,000,000,000 less intense than the loudest sound we can listen to without incurring rapid and permanent hearing loss. In part because of this enormous dynamic range, we tend to use a logarithmic scale, known as decibels (dB), to describe sound pressure or intensity. On this scale, 0 dB sound pressure level (SPL) is defined as 20 micro-Pascals (μPa), which corresponds roughly to the quietest perceptible sound level, and 120 dB SPL is considered dangerously loud.



When the frequency content of different sounds overlaps, masking occurs. Less intense sounds become difficult or impossible to hear because more intense sounds dominate and interfere. Crowded restaurants or busy city streets full of traffic are typical examples of places where certain sounds can “swamp” others. [Image: Peter van der Sluijs, <https://goo.gl/K8L4c0>, CC BY-SA 3.0, <https://goo.gl/eLCn2O>]

Masking is the process by which the presence of one sound makes another sound more difficult to hear. We all encounter masking in our everyday lives, when we fail to hear the phone ring while we are taking a shower, or when we struggle to follow a conversation in a noisy restaurant. In general, a more intense sound will mask a less intense sound, provided certain conditions are met. The most important condition is that the frequency content of the sounds overlap, such that the activity in the cochlea produced by a masking

sound “swamps” that produced by the target sound. Another type of masking, known as “suppression,” occurs when the response to the masker reduces the neural (and in some cases,

the mechanical) response to the target sound. Because of the way that filtering in the cochlea functions, low-frequency sounds are more likely to mask high frequencies than vice versa, particularly at high sound intensities. This asymmetric aspect of masking is known as the “upward spread of masking.” The loss of sharp cochlear tuning that often accompanies cochlear damage leads to broader filtering and more masking—a physiological phenomenon that is likely to contribute to the difficulties experienced by people with hearing loss in noisy environments (**Moore, 2007**).

Although much masking can be explained in terms of interactions within the cochlea, there are other forms that cannot be accounted for so easily, and that can occur even when interactions within the cochlea are unlikely. These more central forms of masking come in different forms, but have often been categorized together under the term “informational masking” (**Durlach et al., 2003; Watson & Kelly, 1978**). Relatively little is known about the causes of informational masking, although most forms can be ascribed to a perceptual “fusion” of the masker and target sounds, or at least a failure to segregate the target from the masking sounds. Also relatively little is known about the physiological locus of informational masking, except that at least some forms seem to originate in the auditory cortex and not before (**Gutschalk, Michey, & Oxenham, 2008**).

Spatial Hearing

In contrast to vision, we have a 360° field of hearing. Our auditory acuity is, however, at least an order of magnitude poorer than vision in locating an object in space. Consequently, our auditory localization abilities are most useful in alerting us and allowing us to orient towards sources, with our visual sense generally providing the finer-grained analysis. Of course,

there are differences between species, and some, such as barn owls and echolocating bats, have developed highly specialized sound localization systems.

Our ability to locate sound sources in space is an impressive feat of neural computation. The two main sources of information both come from a comparison of the sounds at the two ears. The first is based on **interaural time differences (ITD)** and relies on the fact that a sound source on the left will generate sound that will reach the left ear slightly before it reaches the right ear. Although sound is much



Humans are able to locate sound in space to determine whether the source is in front of us or behind us, or whether it is elevated or below us. [Photo: David Goehring, <https://goo.gl/UOLZpB>, CC BY 2.0, <https://goo.gl/BRvSA7>]

slower than light, its speed still means that the time of arrival differences between the two ears is a fraction of a millisecond. The largest ITD we encounter in the real world (when sounds are directly to the left or right of us) are only a little over half a millisecond. With some practice, humans can learn to detect an ITD of between 10 and 20 μ s (i.e., 20 *millionths* of a second) (Klump & Eady, 1956).

The second source of information is based in **interaural level differences (ILDs)**. At higher frequencies (higher than about 1 kHz), the head casts an acoustic “shadow,” so that when a sound is presented from the left, the sound level at the left ear is somewhat higher than the sound level at the right ear. At very high frequencies, the ILD can be as much as 20 dB, and we are sensitive to differences as small as 1 dB.

As mentioned briefly in the discussion of the outer ear,

information regarding the elevation of a sound source, or whether it comes from in front or behind, is contained in high-frequency spectral details that result from the filtering effects of the pinnae.

In general, we are most sensitive to ITDs at low frequencies (below about 1.5 kHz). At higher frequencies we can still perceive changes in timing based on the slowly varying temporal envelope of the sound but not the temporal fine structure (**Bernstein & Trahiotis, 2002; Smith, Delgutte, & Oxenham, 2002**), perhaps because of a loss of neural phase-locking to the temporal fine structure at high frequencies. In contrast, ILDs are most useful at high frequencies, where the head shadow is greatest. This use of different acoustic cues in different frequency regions led to the classic and very early “duplex theory” of sound localization (**Rayleigh, 1907**). For everyday sounds with a broad frequency spectrum, it seems that our perception of spatial location is dominated by interaural time differences in the low-frequency temporal fine structure (**Macpherson & Middlebrooks, 2002**).

As with vision, our perception of distance depends to a large degree on context. If we hear someone shouting at a very low sound level, we infer that the shouter must be far away, based on our knowledge of the sound properties of shouting. In rooms and other enclosed locations, the reverberation can also provide information about distance: As a speaker moves further away, the direct sound level decreases but the sound level of the reverberation remains about the same; therefore, the ratio of direct-to-reverberant energy decreases (**Zahorik & Wightman, 2001**).

Auditory Scene Analysis

There is usually more than one sound source in the environment at any one time—imagine talking with a friend

at a café, with some background music playing, the rattling of coffee mugs behind the counter, traffic outside, and a conversation going on at the table next to yours. All these sources produce sound waves that combine to form a single complex waveform at the eardrum, the shape of which may bear very little relationship to any of the waves produced by the individual sound sources. Somehow the auditory system is able to break down, or decompose, these complex waveforms and allow us to make sense of our acoustic environment by forming separate auditory “objects” or “streams,” which we can follow as the sounds unfold over time (**Bregman, 1990**).

A number of heuristic principles have been formulated to describe how sound elements are grouped to form a single object or segregated to form multiple objects. Many of these originate from the early ideas proposed in vision by the so-called Gestalt psychologists, such as Max Wertheimer. According to these rules of thumb, sounds that are in close proximity, in time or frequency, tend to be grouped together. Also, sounds that begin and end at the same time tend to form a single auditory object. Interestingly, spatial location is not always a strong or reliable grouping cue, perhaps because the location information from individual frequency components is often ambiguous due to the effects of reverberation. Several studies have looked into the relative importance of different cues by “trading off” one cue against another. In some cases, this has led to the discovery of interesting auditory illusions, where melodies that are not present in the sounds presented to either ear emerge in the perception (**Deutsch, 1979**), or where a sound element is perceptually “lost” in competing perceptual organizations (**Shinn-Cunningham, Lee, & Oxenham, 2007**).

More recent attempts have used computational and neutrally based approaches to uncover the mechanisms of auditory scene analysis (e.g., **Elhilali, Ma, Michey, Oxenham, & Shamma, 2009**), and the field of computational auditory scene

analysis (CASA) has emerged in part as an effort to move towards more principled, and less heuristic, approaches to understanding the parsing and perception of complex auditory scenes (e.g., **Wang & Brown, 2006**). Solving this problem will not only provide us with a better understanding of human auditory perception, but may provide new approaches to “smart” hearing aids and cochlear implants, as well as automatic speech recognition systems that are more robust to background noise.

Conclusion



An infant with a cochlear implant.

[Image: Bjorn Knetsch,
<https://goo.gl/J2wCvJ>, CC BY 2.0,
<https://goo.gl/BRvSA7>]

Hearing provides us with our most important connection to the people around us. The intricate physiology of the auditory system transforms the tiny variations in air pressure that reach our ear into the vast array of auditory experiences that we perceive as speech, music, and sounds from the environment around us. We are only beginning to

understand the basic principles of neural coding in higher stages of the auditory system, and how they relate to perception. However, even our rudimentary understanding has improved the lives of hundreds of thousands through devices such as cochlear implants, which re-create some of the ear's functions for people with profound hearing loss.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Cochlea

Snail-shell-shaped organ that transduces mechanical vibrations into neural signals.

Interaural differences

Differences (usually in time or intensity) between the two ears.

Pinna

Visible part of the outer ear.

Tympanic membrane

Ear drum, which separates the outer ear from the middle ear.

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22. Touch and Pain

Original chapter by Guro E. Løseth,
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adapted by the Queen's University
Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

The sensory systems of touch and pain provide us with information about our environment and our bodies that is often crucial for survival and well-being. Moreover, touch is a source of pleasure. In this module, we review how information about our environment and our bodies is coded in the periphery and interpreted by the brain as touch and pain sensations. We discuss how these experiences are often dramatically shaped by top-down factors like motivation, expectation, mood, fear, stress, and context. When well-functioning, these circuits promote survival and prepare us to make adaptive decisions. Pathological loss of touch can result in perceived disconnection from the body, and insensitivity to pain can be very dangerous, leading to maladaptive hazardous behavior. On the other hand, chronic pain conditions, in which these systems start signaling pain in response to innocuous touch or even in the absence of any observable sensory stimuli, have tremendous negative impact on the lives of the affected. Understanding how our sensory-processing mechanisms can

be modulated psychologically and physiologically promises to help researchers and clinicians find new ways to alleviate the suffering of chronic-pain patients

Learning Objectives

- Describe the transduction of somatosensory signals: The properties of the receptor types as well as the difference in the properties of C-afferents and A-afferents and what functions these are thought to have.
- Describe the social touch hypothesis and the role of affective touch in development and bonding.
- Explain the motivation–decision model and descending modulation of pain, and give examples on how this circuitry can promote survival.
- Explain how expectations and context affect pain and touch experiences.
- Describe the concept of chronic pain and why treatment is so difficult.

Introduction

Imagine a life free of pain. How would it be—calm, fearless, serene? Would you feel invulnerable, invincible? Getting rid of **pain** is a popular quest—a quick search for “pain-free life” on Google returns well over 4 million hits—including links to various bestselling self-help guides promising a pain-free life in only 7 steps, 6 weeks, or 3 minutes. Pain management is a billion-dollar market, and involves much more than just pharmaceuticals. Surely a life with no pain would be a better one?

Well, consider one of the “lucky few”: 12-year-old “Thomas” has



Figure 1A: Patient with HSAN-V genetic mutation affecting pain nerve growth. Severely affected 12-year-old boy with damages to his left knee and ankles. (Minde et al., 2004) [Used with permission]

never felt deep pain. Not even when a fracture made him walk around with one leg shorter than the other, so that the bones of his healthy leg were slowly crushed to destruction underneath the knee joint (see Figure 1A). For Thomas and other members of a large Swedish family, life without pain is a harsh reality because of a mutated gene that affects the growth of the nerves conducting deep pain. Most of those affected suffer from joint damage and frequent fractures to bones in their feet and hands; some end up in wheelchairs even before they reach puberty (Minde et al., 2004). It turns out pain—generally—serves us well.

Living without a sense of touch sounds less attractive than being free of pain—touch is a source of pleasure and essential to how we feel. Losing the sense of touch has severe implications—something patient G. L. experienced when an antibiotics treatment damaged the type of nerves that signal touch from her skin and the position of her joints and muscles. She reported feeling like she'd lost her physical self from her nose down, making her “disembodied”—like she no longer had any connection to the body attached to her head. If she didn't look at her arms and legs they could just “wander off” without her knowing—initially she was unable to walk, and even after she relearned this skill

she was so dependent on her visual attention that closing her eyes would cause her to land in a hopeless heap on the floor. Only light caresses like those from her children's hands can make her feel she has a body, but even these sensations remain vague and elusive (Olausson et al., 2002; Sacks, 1985).

Sensation

Cutaneous Senses of the Skin Connect the Brain to the Body and the Outside World

Touch and pain are aspects of the somatosensory system, which provides our brain with information about our own body (**interoception**) and properties of the immediate external world (**exteroception**) (Craig, 2002). We have somatosensory receptors located all over the body, from the surface of our skin to the depth of our joints. The information they send to the central nervous system is generally divided into four modalities: **cutaneous senses** (senses of the skin), proprioception (body position), kinesthesia (body movement), and **nociception** (pain, discomfort). We are going to focus on the cutaneous senses, which respond to tactile, thermal, and pruritic (itchy) stimuli, and events that cause tissue damage (and hence pain). In addition, there is growing evidence for a fifth modality specifically channeling *pleasant* touch (McGlone & Reilly, 2010).

Different Receptor Types Are Sensitive to Specific Stimuli

The skin can convey many sensations, such as the biting cold

of a wind, the comfortable pressure of a hand holding yours, or the irritating itch from a woolen scarf. The different types of information activate specific receptors that convert the stimulation of the skin to electrical nerve impulses, a process called **transduction**. There are three main groups of receptors in our skin: *mechanoreceptors*, responding to mechanical stimuli, such as stroking, stretching, or vibration of the skin; *thermoreceptors*, responding to cold or hot temperatures; and *chemoreceptors*, responding to certain types of chemicals either applied externally or released within the skin (such as histamine from an inflammation). For an overview of the different receptor types and their properties, see Box 1. The experience of *pain* usually starts with activation of **nociceptors**—receptors that fire specifically to potentially tissue-damaging stimuli. Most of the nociceptors are subtypes of either chemoreceptors or mechanoreceptors. When tissue is damaged or inflamed, certain chemical substances are released from the cells, and these substances activate the chemosensitive nociceptors. Mechanoreceptive nociceptors have a high threshold for activation—they respond to mechanical stimulation that is so intense it might damage the tissue.

Box 1. Categories of low-threshold mechanoreceptors*

Identity of receptor	Size of receptor*	Type of skin where found	Speed of adaptation*	Adequate stimulus*
Merkel's disks	Small, sharp borders	Glabrous*	Slow	Pressure
Meissner's corpuscles	Small, sharp borders	Glabrous	Rapid	Indentation
Ruffini corpuscles	Large, diffuse borders	Hairy + glabrous	Slow	Stretching
Pacinian corpuscles	Large, diffuse borders	Hairy + glabrous	Rapid	Vibration

* **Adequate stimulus:** The type of stimulus that the receptor is specialized to receive and respond to.

* **Glabrous Skin:** The hairless skin found on our palms and the soles of our feet. This skin has a higher density of receptors of a more complex range, which reflects the fact that we use these areas of our body to actively explore our surroundings and to discriminate tactile properties of objects we're interacting with.

* **Low-threshold mechanoreceptors:** Mechanoreceptors that respond to stimulus that is so light it doesn't threaten to damage the tissue around it. High-threshold mechanoreceptors respond to stimulation of higher intensity, and are a type of nociceptor.

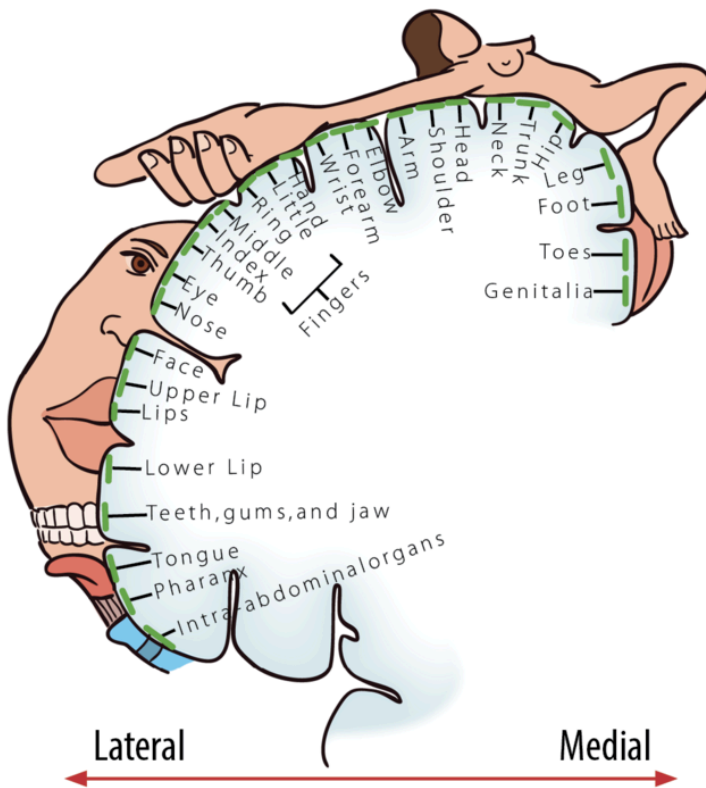
* **Receptive field:** The space of skin or tissue in which stimulation will elicit a response in the receptor. Smaller receptive fields make the receptor more sensitive to details.

* **Speed adaptation:** Slowly adapting mechanoreceptors continue to fire action potentials during sustained stimulation. Rapidly adapting mechanoreceptors fire action potentials in response to stimulus onset and offset (i.e. to stimuli changes), and help detect stimulus movement on the skin.

Action Potentials in the Receptor Cells Travel as Nerve Impulses with Different Speeds

When you step on a pin, this activates a host of mechanoreceptors, many of which are nociceptors. You may have noticed that the sensation changes over time. First you feel a sharp stab that propels you to remove your foot, and only then you feel a wave of more aching pain. The sharp stab is signaled via fast-conducting **A-fibers**, which project to the **somatosensory cortex**. This part of the cortex is **somatotopically organized**—that is, the sensory signals are represented according to where in the body they stem from

(see Illustration, Figure 2). The unpleasant ache you feel after the sharp pin stab is a separate, simultaneous signal sent from the nociceptors in your foot via thin **C-pain or A δ -fibers** to the insular cortex and other brain regions involved in processing of emotion and interoception (see Figure 3a for a schematic representation of this pathway). The experience of stepping on a pin is, in other words, composed by two separate signals: one discriminatory signal allowing us to localize the touch stimulus and distinguish whether it's a blunt or a sharp stab; and one affective signal that lets us know that stepping on the pin is bad. It is common to divide pain into sensory–discriminatory and affective–motivational aspects (**Auvray, Myin, & Spence, 2010**). This distinction corresponds, at least partly, to how this information travels from the peripheral to the central nervous system and how it is processed in the brain (**Price, 2000**).



Somatosensory Map

Figure 2: Somatosensory map: Body parts are represented in specific locations on the somatosensory cortex. Representations map out somatotopically, with the feet located medially and shoulders and arms laterally to the interhemispheric fissure. Facial structures are represented in a different location to the scalp and head; the face oriented upside down with the forehead pointing towards the shoulders.

Affective Aspects of Touch Are Important for Development and Relationships

Touch senses are not just there for discrimination or detection of potentially painful events, as Harlow and Suomi (1970) demonstrated in a series of heartbreaking experiments where baby monkeys were taken from their mothers. The infant monkeys could choose between two artificial surrogate mothers—one “warm” mother without food but with a furry, soft cover; and one cold, steel mother with food. The monkey babies spent most of their time clinging to the soft mother, and only briefly moved over to the hard, steel mother to feed, indicating that touch is of “overpowering importance” to the infant (Harlow & Suomi, 1970, p. 161). Gentle touch is central for creating and maintaining social relationships in primates; they groom each other by stroking the fur and removing parasites—an activity important not only for their individual well-being but also for group cohesion (Dunbar, 2010; Keverne, Martensz, & Tuite, 1989). Although people don’t groom each other in the same way, gentle touch is important for us, too.

The sense of touch is the first to develop while one is in the womb, and human infants crave touch from the moment they’re born. From studies of human orphans, we know that touch is also crucial for human development. In Romanian orphanages where the babies were fed but not given regular attention or physical contact, the children suffered cognitive and neurodevelopmental delay (Simons & Land, 1987). Physical contact helps a crying baby calm down, and the soothing touch a mother gives to her child is thought to reduce the levels of stress hormones such as cortisol. High levels of cortisol have negative effects on neural development, and they can even lead to cell loss (Feldman, Singer, & Zagoory, 2010; Fleming, O’Day, & Kraemer, 1999; Pechtel & Pizzagalli, 2011). Thus, stress reduction through hugs and caresses might

be important not only for children's well-being, but also for the development of the infant brain.

The skin senses are similar across species, likely reflecting the evolutionary advantage of being able to tell what is touching you, where it's happening, and whether or not it's likely to cause tissue damage. An intriguing line of touch research suggests that humans, cats, and other animals have a special, evolutionarily preserved system that promotes gentle touch because it carries social and emotional significance. On a peripheral level, this system consists of a subtype of **C-fibers** that responds not to painful stimuli, but rather to gentle stroking touch—called **C-tactile fibers**. The firing rate of the C-tactile fibers correlates closely with how pleasant the stroking feels—suggesting they are coding specifically for the gentle caresses typical of social affiliative touch (Löken, Wessberg, Morrison, McGlone, & Olausson, 2009). This finding has led to the **social touch hypothesis**, which proposes that C-tactile fibers form a system for touch perception that supports social bonding (Morrison, Löken, & Olausson, 2010; Olausson, Wessberg, Morrison, McGlone, & Vallbo, 2010). The discovery of the C-tactile system suggests that touch is organized in a similar way to pain; fast-conducting A-fibers contribute to sensory–discriminatory aspects, while thin C-fibers contribute to affective–motivational aspects (Löken, Wessberg, Morrison, McGlone, & Olausson, 2009). However, while these “hard-wired” afferent systems often provide us with accurate information about our environment and our bodies, how we experience touch or pain depends very much on top-down sources like motivation, expectation, mood, fear, and stress.

Modulation

Pain Is Necessary for Survival, but Our

Brain Can Stop It if It Needs To

In April 2003, the climber Aron Ralston found himself at the floor of Blue John Canyon in Utah, forced to make an appalling choice: face a slow but certain death—or amputate his right arm. Five days earlier he fell down the canyon—since then he had been stuck with his right arm trapped between an 800-lb boulder and the steep sandstone wall. Weak from lack of food and water and close to giving up, it occurred to him like an epiphany that if he broke the two bones in his forearm he could manage to cut off the rest with his pocket knife. The thought of freeing himself and surviving made him so excited he spent the next 40 minutes completely engrossed in the task: first snapping his bones using his body as a lever, then sticking his fingers into the arm, pinching bundles of muscle fibers and severing them one by one, before cutting the blue arteries and the pale “noodle-like” nerves. The pain was unimportant. Only cutting through the thick white main nerve made him stop for a minute—the flood of pain, he describes, was like thrusting his entire arm “into a cauldron of magma.” Finally free, he rappelled down a cliff and walked another 7 miles until he was rescued by some hikers (**Ralston, 2010**). How is it possible to do something so excruciatingly painful to yourself, and still manage to walk, talk, and think rationally afterwards? The answer lies within the brain, where signals from the body are interpreted. When we perceive somatosensory and nociceptive signals from the body, the experience is highly subjective and malleable by motivation, attention, emotion, and context.

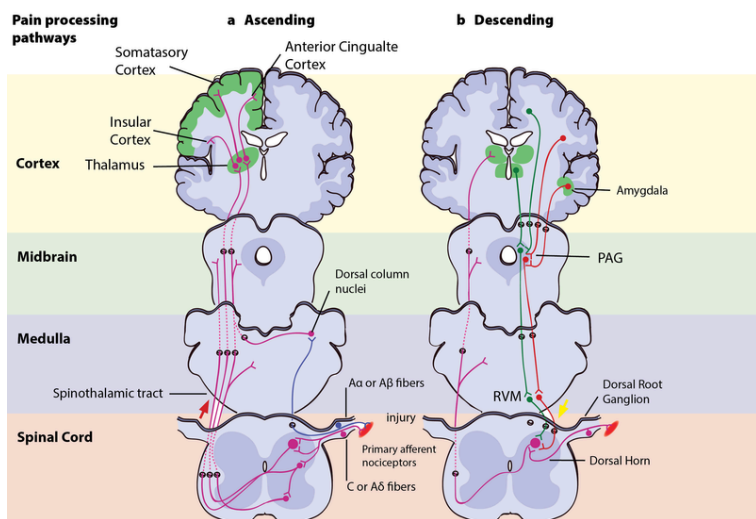


Figure 3: Pain processing pathways

Left – Ascending pain pathways: An injury is signaled simultaneously via fast-conducting Aα or Aβ-fibers and slow-conducting C-pain or Aδ-fibers. The fast A-fibers signal pressure, stretching and other tissue movements to the somatosensory cortex via the dorsal column nuclei. The C-pain and Aδ-fibers send pain information from nociceptors in the tissue or skin, and transmit these signals to second order neurons in the dorsal horn of the spinal cord. The second order neurons then cross over to the opposite side, where they form the ascending spinothalamic tract. This tract projects signals to nuclei in the medulla and midbrain on the way up to the thalamus (T). The thalamus relays the information to the somatosensory and insular cortex, as well as cortical regions mediating different aspects of the pain experience such as affective responses in the cingulate cortex.

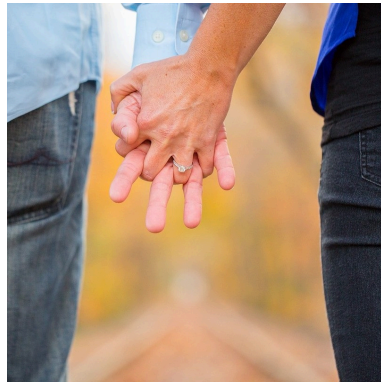
Right – Descending pain modulation pathways: Information from the environment and certain motivational states can activate this top-down pathway. Several areas in the limbic forebrain including the anterior cingulate and insular cortex, nuclei in the amygdala and the hypothalamus (H), project to the midbrain periaqueductal grey (PAG), which then modulates ascending pain transmission from the afferent pain system indirectly through the rostral ventromedial medulla (RVM) in the brainstem. This modulating system produces analgesia by the release of endogenous opioids, and uses ON- and OFF-cells to exert either inhibitory (green) or facilitatory (red) control of nociceptive signals at the spinal dorsal horn.

The Motivation–Decision Model and Descending Modulation of Pain

According to the *motivation–decision model*, the brain automatically and continuously evaluates the pros and cons of any situation—weighing impending threats and available rewards (Fields, 2004, 2006). Anything more important for survival than avoiding the pain activates the brain’s **descending pain modulatory system**—a top-down system involving several parts of the brain and brainstem, which inhibits nociceptive signaling so that the more important actions can be attended to (Figure 3b). In Aron’s extreme case, his actions were likely based on such an unconscious decision process—taking into account his homeostatic state (his hunger, thirst, the inflammation and decay of his crushed hand slowly affecting the rest of his body), the sensory input available (the sweet smell of his dissolving skin, the silence around him indicating his solitude), and his knowledge about the threats facing him (death, or excruciating pain that won’t kill him) versus the potential rewards (survival, seeing his family again). Aron’s story illustrates the evolutionary advantage to being able to shut off pain: The descending pain modulatory system allows us to go through with potentially life-saving actions. However, when one has reached safety or obtained the reward, healing is more important. The very same descending system can then “crank up” nociception from the body to promote healing and motivate us to avoid potentially painful actions. To facilitate or inhibit nociceptive signals from the body, the descending pain modulatory system uses a set of ON- or OFF-cells in the brainstem, which regulates how much of the nociceptive signal reaches the brain. The descending system is dependent on opioid signaling, and **analgesics** like morphine relieve pain via this circuit (Petrovic, Kalso, Petersson, & Ingvar, 2002).

The Analgesic Power of Reward

Thinking about the good things, like his loved ones and the life ahead of him, was probably pivotal to Aron's survival. The promise of a reward can be enough to relieve pain. Expecting pain relief (getting less pain is often the best possible outcome if you're in pain, i.e., it is a reward) from a medical treatment contributes to the **placebo effect**—where pain relief is due at least partly to your brain's descending modulation



Social rewards, like holding the hands or just seeing the picture of a loved one, can reduce sensations of pain. [Image: rogerl01, CCO Public Domain, <https://goo.gl/m25gce>]

circuit, and such relief depends on the brain's own opioid system (Eippert et al., 2009; Eippert, Finsterbusch, Bingel, & Buchel, 2009; Levine, Gordon, & Fields, 1978). Eating tasty food, listening to good music, or feeling pleasant touch on your skin also decreases pain in both animals and humans, presumably through the same mechanism in the brain (Leknes & Tracey, 2008). In a now classic experiment, Dum and Herz (1984) either fed rats normal rat food or let them feast on highly rewarding chocolate-covered candy (rats love sweets) while standing on a metal plate until they learned exactly what to expect when placed there. When the plate was heated up to a noxious/painful level, the rats that expected candy endured the temperature for twice as long as the rats expecting normal chow. Moreover, this effect was completely abolished when the rats' opioid (endorphin) system was blocked with a drug, indicating that the analgesic effect of reward anticipation was caused by **endorphin** release.

For Aron the climber, both the stress from knowing that death was impending and the anticipation of the reward it would be to survive probably flooded his brain with endorphins, contributing to the wave of excitement and euphoria he experienced while he carried out the amputation “like a five-year-old unleashed on his Christmas presents” (**Ralston, 2010**). This altered his experience of the pain from the extreme tissue damage he was causing and enabled him to focus on freeing himself. Our brain, it turns out, can modulate the perception of how unpleasant pain is, while still retaining the ability to experience the intensity of the sensation (**Rainville, Duncan, Price, Carrier, & Bushnell, 1997; Rainville, Feine, Bushnell, & Duncan, 1992**). Social rewards, like holding the hand of your boyfriend or girlfriend, have pain-reducing effects. Even looking at a picture of him/her can have similar effects—in fact, seeing a picture of a person we feel close to not only reduces subjective pain ratings, but also the activity in pain-related brain areas (**Eisenberger et al., 2011**). The most common things to do when wanting to help someone through a painful experience—being present and holding the person’s hand—thus seems to have a measurably positive effect.

When Touch Becomes Painful or Pain Becomes Chronic

Chances are you’ve been sunburned a few times in your life and have experienced how even the lightest pat on the back or the softest clothes can feel painful on your over-sensitive skin. This condition, where innocuous touch gives a burning, tender sensation, is similar to a chronic condition called **allodynia**—where neuronal disease or injury makes touch that is normally pleasant feel unpleasantly painful. In allodynia, neuronal injury in the spinal dorsal horn causes Aβ-

afferents, which are activated by non-nociceptive touch, to access nociceptive pathways (Liljencrantz et al., 2013). The result is that even gentle touch is interpreted by the brain as painful. While an acute pain response to **noxious stimuli** has a vital protective function, allodynia and other **chronic pain** conditions constitute a tremendous source of unnecessary suffering that affects millions of people. Approximately 100 million Americans suffer from chronic pain, and annual economic cost associated is estimated to be \$560–\$635 billion (Committee on Advancing Pain Research, Care, & Institute of Medicine, 2011). Chronic pain conditions are highly diverse, and they can involve changes on peripheral, spinal, central, and psychological levels. The mechanisms are far from fully understood, and developing appropriate treatment remains a huge challenge for pain researchers.

Chronic pain conditions often begin with an injury to a peripheral nerve or the tissue surrounding it, releasing hormones and inflammatory molecules that *sensitize* nociceptors. This makes the nerve and neighboring afferents more excitable, so that also uninjured nerves become hyperexcitable and contribute to the persistence of pain. An injury might also make neurons fire nonstop regardless of external stimuli, providing near-constant input to the pain system. **Sensitization** can also happen in the brain and in the descending modulatory system of the brainstem (Zambreanu, Wise, Brooks, Iannetti, & Tracey, 2005). Exactly on which levels the pain perception is altered in chronic pain patients can be extremely difficult to pinpoint, making treatment an often exhausting process of trial and error. Suffering from chronic pain has dramatic impacts on the lives of the afflicted. Being in pain over a longer time can lead to depression, anxiety (fear or anticipation of future pain), and immobilization, all of which may in turn exacerbate pain (Wiech & Tracey, 2009). Negative emotion and attention to pain can increase sensitization to pain, possibly by keeping

the descending pain modulatory system in facilitation mode. Distraction is therefore a commonly used technique in hospitals where patients have to undergo painful treatments like changing bandages on large burns. For chronic pain patients, however, diverting attention is not a long-term solution. Positive factors like social support can reduce the risk of chronic pain after an injury, and so they can help to adjust to bodily change as a result of injury. We have already talked about how having a hand to hold might alleviate suffering. Chronic pain treatment should target these emotional and social factors as well as the physiological.

The Power of the Mind



How powerful is the mind really? Well, the next time you have dental work done, know that some people opt for no Novocain, using only the power of their minds to overcome the pain. [Image: HypnoArt, CC0 Public Domain, <https://goo.gl/m25gce>]

The context of pain and touch has a great impact on how we interpret it. Just imagine how different it would feel to Aron if someone amputated his hand against his will and for no discernible reason. Prolonged pain from injuries can be easier to bear if the incident causing them provides a positive context—like a war wound that testifies to a soldier's courage and commitment—or **phantom pain** from a hand that was

cut off to enable life to carry on. The relative meaning of pain is illustrated by a recent experiment, where the same moderately painful heat was administered to participants in two different

contexts—one control context where the alternative was a nonpainful heat; and another where the alternative was an intensely painful heat. In the control context, where the moderate heat was the least preferable outcome, it was (unsurprisingly) rated as painful. In the other context it was the best possible outcome, and here the exact same moderately painful heat was actually rated as *pleasant*—because it meant the intensely painful heat had been avoided. This somewhat surprising change in perception—where pain becomes pleasant because it represents relief from something worse—highlights the importance of the meaning individuals ascribe to their pain, which can have decisive effects in pain treatment (**Leknes et al., 2013**). In the case of touch, knowing who or what is stroking your skin can make all the difference—try thinking about slugs the next time someone strokes your skin if you want an illustration of this point. In a recent study, a group of heterosexual males were told that they were about to receive sensual caresses on the leg by either a male experimenter or by an attractive female experimenter (**Gazzola et al., 2012**). The study participants could not see who was touching them. Although it was always the female experimenter who performed the caress, the heterosexual males rated the otherwise pleasant sensual caresses as clearly unpleasant when they believed the male experimenter did it. Moreover, brain responses to the “male touch” in somatosensory cortex were reduced, exemplifying how top-down regulation of touch resembles top-down pain inhibition.

Pain and pleasure not only share modulatory systems—another common attribute is that we don’t need to be on the receiving end of it ourselves in order to experience it. How did you feel when you read about Aron cutting through his own tissue, or “Thomas” destroying his own bones unknowingly? Did you cringe? It’s quite likely that some of your brain areas processing affective aspects of pain were active even though the nociceptors in your skin and deep tissue were

not firing. Pain can be experienced vicariously, as can itch, pleasurable touch, and other sensations. Tania Singer and her colleagues found in an fMRI study that some of the same brain areas that were active when participants felt pain on their own skin (anterior cingulate and insula) were also active when they were given a signal that a loved one was feeling the pain. Those who were most “empathetic” also showed the largest brain responses (**Singer et al., 2004**). A similar effect has been found for pleasurable touch: The posterior insula of participants watching videos of someone else’s arm being gently stroked shows the same activation as if they were receiving the touch themselves (**Morrison, Bjornsdotter, & Olausson, 2011**).

The Study of Pain at Queen’s University

We are fortunate to have psychological scientists here at Queen’s who actively research and teach about pain. Dr. Caroline Pukall, Dr. Dean Tripp, and Dr. Tim Salomons are three of our experts, and in this video they discuss their approaches to the study of pain.



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View video in full screen (opens in a new tab)

Summary

Sensory experiences connect us to the people around us, to the rest of the world, and to our own bodies. Pleasant or unpleasant, they're part of being human. In this module, we have seen how being able to inhibit pain responses is central to our survival—and in cases like that of climber Aron Ralston, that ability can allow us to do extreme things. We have also seen how important the ability to feel pain is to our health—illustrated by young “Thomas,” who keeps injuring himself because he simply doesn't notice pain. While “Thomas” has to learn to avoid harmful activities without the sensory input that normally guides us, G. L. has had to learn how to keep approaching and move about in a world she can hardly feel at all, with a body that is practically disconnected from her awareness. Too little sensation or too much of it leads to no good, no matter how pleasant or unpleasant the sensation usually feels. As long as we have nervous systems that function normally, we are able to adjust the volume of the sensory signals and our behavioral reactions according to the context we're in. When it comes to sensory signals like touch and pain, we are interpreters, not measuring instruments. The quest for understanding how our sensory-processing mechanisms can be modulated, psychologically and physiologically, promises to help researchers and clinicians find new ways to alleviate distress from chronic pain.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this

module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

A-fibers

Fast-conducting sensory nerves with myelinated axons. Larger diameter and thicker myelin sheaths increases conduction speed. A β -fibers conduct touch signals from low-threshold mechanoreceptors with a velocity of 80 m/s and a diameter of 10 μ m; A δ -fibers have a diameter of 2.5 μ m and conduct cold, noxious, and thermal signals at 12 m/s. The third and fastest conducting A-fiber is the A α , which conducts proprioceptive information with a velocity of 120 m/s and a diameter of 20 μ m.

Allodynia

Pain due to a stimulus that does not normally provoke pain, e.g., when a light, stroking touch feels painful.

Analgesia

Pain relief.

C-fibers

C-fibers: Slow-conducting unmyelinated thin sensory afferents with a diameter of 1 μm and a conduction velocity of approximately 1 m/s. C-pain fibers convey noxious, thermal, and heat signals; C-tactile fibers convey gentle touch, light stroking.

Chronic pain

Persistent or recurrent pain, beyond usual course of acute illness or injury; sometimes present without observable tissue damage or clear cause.

C-pain or A δ -fibers

C-pain fibers convey noxious, thermal, and heat signals

C-tactile fibers

C-tactile fibers convey gentle touch, light stroking

Cutaneous senses

The senses of the skin: tactile, thermal, pruritic (itchy), painful, and pleasant.

Descending pain modulatory system

A top-down pain-modulating system able to inhibit or facilitate pain. The pathway produces analgesia by the release of endogenous opioids. Several brain structures and nuclei are part of this circuit, such as the frontal lobe areas of the anterior cingulate cortex, orbitofrontal cortex, and insular cortex; and nuclei in the amygdala and the hypothalamus, which all project to a structure in the midbrain called the periaqueductal grey (PAG). The PAG then controls ascending pain transmission from the afferent pain system indirectly through the rostral ventromedial medulla (RVM) in the brainstem, which uses

ON- and OFF-cells to inhibit or facilitate nociceptive signals at the spinal dorsal horn.

Endorphin

An endogenous morphine-like peptide that binds to the opioid receptors in the brain and body; synthesized in the body's nervous system.

Exteroception

The sense of the external world, of all stimulation originating from outside our own bodies.

Interoception

The sense of the physiological state of the body. Hunger, thirst, temperature, pain, and other sensations relevant to homeostasis. Visceral input such as heart rate, blood pressure, and digestive activity give rise to an experience of the body's internal states and physiological reactions to external stimulation. This experience has been described as a representation of "the material me," and it is hypothesized to be the foundation of subjective feelings, emotion, and self-awareness.

Nociception

The neural process of encoding noxious stimuli, the sensory input from nociceptors. Not necessarily painful, and crucially not necessary for the experience of pain.

Nociceptors

High-threshold sensory receptors of the peripheral somatosensory nervous system that are capable of transducing and encoding noxious stimuli. Nociceptors send information about actual or impending tissue damage to the brain. These signals can often lead to pain, but nociception and pain are not the same.

Noxious stimulus

A stimulus that is damaging or threatens damage to normal tissues.

Social touch hypothesis

Proposes that social touch is a distinct domain of touch. C-tactile afferents form a special pathway that distinguishes social touch from other types of touch by selectively firing in response to touch of social-affective relevance; thus sending affective information parallel to the discriminatory information from the A β -fibers. In this way, the socially relevant touch stands out from the rest as having special positive emotional value and is processed further in affect-related brain areas such as the insula.

Pain

Defined as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage,” according to the International Association for the Study of Pain.

Phantom pain

Pain that appears to originate in an amputated limb.

Placebo effect

Effects from a treatment that are not caused by the physical properties of a treatment but by the meaning ascribed to it. These effects reflect the brain's own activation of modulatory systems, which is triggered by positive expectation or desire for a successful treatment. Placebo analgesia is the most well-studied placebo effect and has been shown to depend, to a large degree, on opioid mechanisms. Placebo analgesia can be reversed by the pharmacological blocking of μ opioid receptors. The word “placebo” is probably derived from the Latin word “placebit” (“it will please”).

Sensitization

Increased responsiveness of nociceptive neurons to their normal input and/or recruitment of a response to normally subthreshold inputs. Clinically, sensitization may only be inferred indirectly from phenomena such as hyperalgesia or allodynia. Sensitization can occur in the central nervous system (central sensitization) or in the periphery (peripheral sensitization).

Social touch hypothesis

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Somatosensory cortex

Consists of primary sensory cortex (S1) in the postcentral gyrus in the parietal lobes and secondary somatosensory cortex (S2), which is defined functionally and found in the upper bank of the lateral sulcus, called the parietal operculum. Somatosensory cortex also includes parts of the insular cortex.

Somatotopically organized

When the parts of the body that are represented in a particular brain region are organized topographically according to their physical location in the body (see Figure 2 illustration).

Spinothalamic tract

Runs through the spinal cord's lateral column up to the thalamus. C-fibers enter the dorsal horn of the spinal cord

and form a synapse with a neuron that then crosses over to the lateral column and becomes part of the spinothalamic tract.

Transduction

The mechanisms that convert stimuli into electrical signals that can be transmitted and processed by the nervous system. Physical or chemical stimulation creates action potentials in a receptor cell in the peripheral nervous system, which is then conducted along the axon to the central nervous system.

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PSYC 100 VIII

THE VISUAL WORLD

23. Multi-Modal Perception

Original chapter by Lorin Lachs adapted by the Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

Most of the time, we perceive the world as a unified bundle of sensations from multiple sensory modalities. In other words, our perception is multimodal. This module provides an overview of multimodal perception, including information about its neurobiology and its psychological effects.

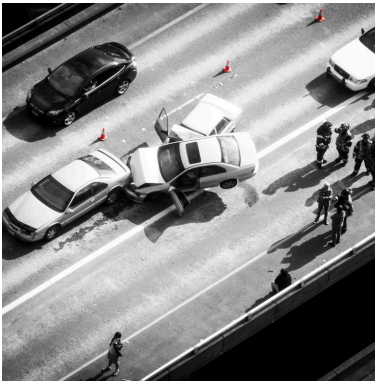
Learning Objectives

- Define the basic terminology and basic principles of multimodal perception.
- Describe the neuroanatomy of multisensory integration and name some of the regions of the cortex and midbrain that have been implicated in multisensory processing.
- Explain the difference between multimodal phenomena and crossmodal phenomena.

- Give examples of multimodal and crossmodal behavioral effects.

Perception: Unified

Although it has been traditional to study the various senses independently, most of the time, perception operates in the context of information supplied by multiple **sensory modalities** at the same time. For example, imagine if you witnessed a car collision. You could describe the stimulus generated by this event by considering each of the senses independently; that is, as a set of **unimodal** stimuli. Your eyes would be stimulated with patterns of light energy bouncing off the cars involved. Your ears would be stimulated with patterns of acoustic energy emanating from the collision. Your nose might even be stimulated by the smell of burning rubber or gasoline.



If you were a witness to this scene you'd be able to describe it using input from many of your senses. Your experience would be multimodal. [Image: Photo Grrrrr, <https://goo.gl/dzfKs8>, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

However, all of this information would be relevant to the same thing: your perception of the car collision. Indeed, unless someone was to explicitly ask you to describe your perception in unimodal terms, you would most likely experience the event as a unified bundle of sensations from multiple senses. In other words, your perception would be **multimodal**. The question is whether the various sources of information involved in this

multimodal stimulus are processed separately by the perceptual system or not.

For the last few decades, perceptual research has pointed to the importance of **multimodal perception**: the effects on the perception of events and objects in the world that are observed when there is information from more than one sensory modality. Most of this research indicates that, at some point in perceptual processing, information from the various sensory modalities is **integrated**. In other words, the information is combined and treated as a unitary representation of the world.

Questions About Multimodal Perception

Several theoretical problems are raised by multimodal perception. After all, the world is a “blooming, buzzing world of confusion” that constantly bombards our perceptual system with light, sound, heat, pressure, and so forth. To make matters more complicated, these stimuli come from multiple events spread out over both space and time. To return to our example: Let’s say the car crash you observed happened on Main Street in your town. Your perception during the car crash might include a lot of stimulation that was *not* relevant to the car crash. For example, you might also overhear the conversation of a nearby couple, see a bird flying into a tree, or smell the delicious scent of freshly baked bread from a nearby bakery (or all three!). However, you would most likely not make the mistake of associating any of these stimuli with the car crash. In fact, we rarely combine the auditory stimuli associated with one event with the visual stimuli associated with another (although, under some unique circumstances—such as ventriloquism—we do). How is the brain able to take the information from separate sensory modalities and match it appropriately, so that stimuli that belong together stay

together, while stimuli that do not belong together get treated separately? In other words, how does the perceptual system determine which unimodal stimuli must be integrated, and which must not?

Once unimodal stimuli have been appropriately integrated, we can further ask about the consequences of this integration: What are the effects of multimodal perception that would not be present if perceptual processing were only unimodal? Perhaps the most robust finding in the study of multimodal perception concerns this last question. No matter whether you are looking at the actions of neurons or the behavior of individuals, it has been found that responses to multimodal stimuli are typically greater than the combined response to either modality independently. In other words, if you presented the stimulus in one modality at a time and measured the response to each of these unimodal stimuli, you would find that adding them together would still not equal the response to the multimodal stimulus. This **superadditive effect of multisensory integration** indicates that there are consequences resulting from the integrated processing of multimodal stimuli.

The extent of the superadditive effect (sometimes referred to as **multisensory enhancement**) is determined by the strength of the response to the single stimulus modality with the biggest effect. To understand this concept, imagine someone speaking to you in a noisy environment (such as a crowded party). When discussing this type of multimodal stimulus, it is often useful to describe it in terms of its **unimodal components**: In this case, there is an auditory component (the sounds generated by the speech of the person speaking to you) and a visual component (the visual form of the face movements as the person speaks to you). In the crowded party, the auditory component of the person's speech might be difficult to process (because of the surrounding party noise). The potential for visual information about

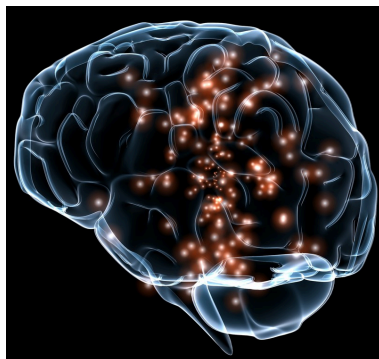
speech—lipreading—to help in understanding the speaker's message is, in this situation, quite large. However, if you were listening to that same person speak in a quiet library, the auditory portion would probably be sufficient for receiving the message, and the visual portion would help very little, if at all (**Sumby & Pollack, 1954**). In general, for a stimulus with multimodal components, if the response to each component (on its own) is weak, then the opportunity for multisensory enhancement is very large. However, if one component—by itself—is sufficient to evoke a strong response, then the opportunity for multisensory enhancement is relatively small. This finding is called the **Principle of Inverse Effectiveness** (**Stein & Meredith, 1993**) because the effectiveness of multisensory enhancement is inversely related to the unimodal response with the greatest effect.

Another important theoretical question about multimodal perception concerns the neurobiology that supports it. After all, at some point, the information from each sensory modality is definitely separated (e.g., light comes in through the eyes, and sound comes in through the ears). How does the brain take information from different neural systems (optic, auditory, etc.) and combine it? If our experience of the world is multimodal, then it must be the case that at some point during perceptual processing, the unimodal information coming from separate sensory organs—such as the eyes, ears, skin—is combined. A related question asks where in the brain this integration takes place. We turn to these questions in the next section.

Biological Bases of Multimodal Perception

Multisensory Neurons and Neural Convergence

A surprisingly large number of brain regions in the midbrain and cerebral cortex are related to multimodal perception. These regions contain neurons that respond to stimuli from not just one, but multiple sensory modalities. For example, a region called the superior temporal sulcus contains single neurons that respond to both the visual and auditory components of speech



In order for us to perceive the world effectively, neurons from our various senses carry information that is integrated in the brain.

[Image: DARPA, <https://goo.gl/kat7ws>, CC0 Public Domain, <https://goo.gl/m25gce>]

(Calvert, 2001; Calvert, Hansen,

Iversen, & Brammer, 2001). These **multisensory convergence zones** are interesting, because they are a kind of neural intersection of information coming from the different senses. That is, neurons that are devoted to the processing of one sense at a time—say vision or touch—send their information to the convergence zones, where it is processed together.

One of the most closely studied multisensory convergence zones is the superior colliculus (Stein & Meredith, 1993), which receives inputs from many different areas of the brain, including regions involved in the unimodal processing of visual and auditory stimuli (Edwards, Ginsburgh, Henkel, & Stein,

1979). Interestingly, the superior colliculus is involved in the “orienting response,” which is the behavior associated with moving one’s eye gaze toward the location of a seen or heard stimulus. Given this function for the superior colliculus, it is hardly surprising that there are multisensory neurons found there (Stein & Stanford, 2008).

Crossmodal Receptive Fields

The details of the anatomy and function of multisensory neurons help to answer the question of how the brain integrates stimuli appropriately. In order to understand the details, we need to discuss a neuron’s receptive field. All over the brain, neurons can be found that respond only to stimuli presented in a very specific region of the space immediately surrounding the perceiver. That region is called the neuron’s **receptive field**. If a stimulus is presented in a neuron’s receptive field, then that neuron responds by increasing or decreasing its firing rate. If a stimulus is presented outside of a neuron’s receptive field, then there is no effect on the neuron’s firing rate. Importantly, when two neurons send their information to a third neuron, the third neuron’s receptive field is the combination of the receptive fields of the two input neurons. This is called neural convergence, because the information from multiple neurons converges on a single neuron. In the case of multisensory neurons, the convergence arrives from different sensory modalities. Thus, the receptive fields of multisensory neurons are the combination of the receptive fields of neurons located in different sensory pathways.

Now, it could be the case that the neural convergence that results in multisensory neurons is set up in a way that ignores the locations of the input neurons’ receptive fields. Amazingly, however, these **crossmodal receptive fields** overlap. For

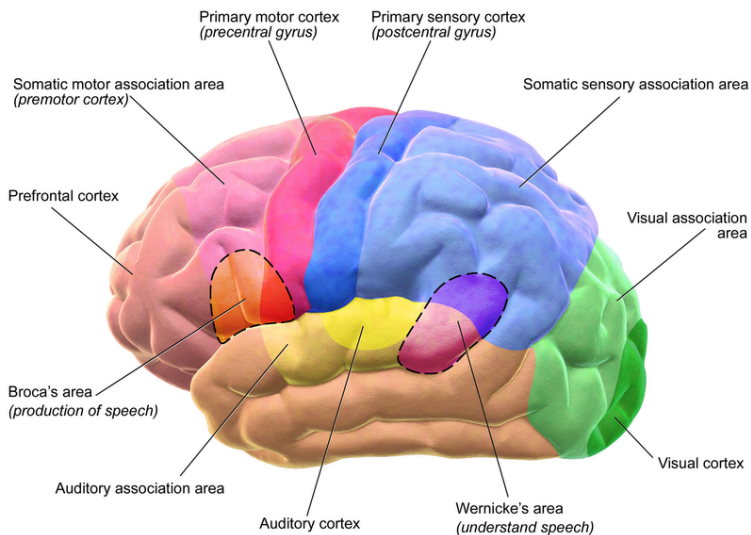
example, a multisensory neuron in the superior colliculus might receive input from two unimodal neurons: one with a visual receptive field and one with an auditory receptive field. It has been found that the unimodal receptive fields refer to the same locations in space—that is, the two unimodal neurons respond to stimuli in the same region of space. Crucially, the overlap in the crossmodal receptive fields plays a vital role in the integration of **crossmodal stimuli**. When the information from the separate modalities is coming from within these overlapping receptive fields, then it is treated as having come from the same location—and the neuron responds with a superadditive (enhanced) response. So, part of the information that is used by the brain to combine multimodal inputs is the location in space from which the stimuli came.

This pattern is common across many multisensory neurons in multiple regions of the brain. Because of this, researchers have defined the **spatial principle of multisensory integration**: Multisensory enhancement is observed when the sources of stimulation are spatially related to one another. A related phenomenon concerns the *timing* of crossmodal stimuli. Enhancement effects are observed in multisensory neurons only when the inputs from different senses arrive within a short time of one another (e.g., **Recanzone, 2003**).

Multimodal Processing in Unimodal Cortex

Multisensory neurons have also been observed outside of multisensory convergence zones, in areas of the brain that were once thought to be dedicated to the processing of a single modality (**unimodal cortex**). For example, the **primary visual cortex** was long thought to be devoted to the processing of exclusively visual information. The primary visual cortex is the

first stop in the cortex for information arriving from the eyes, so it processes very low-level information like edges. Interestingly, neurons have been found in the primary visual cortex that receives information from the **primary auditory cortex** (where sound information from the auditory pathway is processed) and from the superior temporal sulcus (a multisensory convergence zone mentioned above). This is remarkable because it indicates that the processing of visual information is, from a very early stage, influenced by auditory information.



There are zones in the human brain where sensory information comes together and is integrated such as the Auditory, Visual and Motor Cortices pictured here. [Image: BruceBlaus, <https://goo.gl/UqKBI3>, CC BY 3.0, <https://goo.gl/b58TcB>]

There may be two ways for these multimodal interactions to occur. First, it could be that the processing of auditory information in relatively late stages of processing feeds back to influence low-level processing of visual information in unimodal cortex (**McDonald, Teder-Sälejärvi, Russo, & Hillyard,**

2003). Alternatively, it may be that areas of unimodal cortex contact each other directly (**Driver & Noesselt, 2008; Macaluso & Driver, 2005**), such that multimodal integration is a fundamental component of all sensory processing.

In fact, the large numbers of multisensory neurons distributed all around the cortex—in multisensory convergence areas and in primary cortices—has led some researchers to propose that a drastic reconceptualization of the brain is necessary (**Ghazanfar & Schroeder, 2006**). They argue that the cortex should not be considered as being divided into isolated regions that process only one kind of sensory information. Rather, they propose that these areas only *prefer* to process information from specific modalities but engage in low-level multisensory processing whenever it is beneficial to the perceiver (**Vasconcelos et al., 2011**).

Behavioral Effects of Multimodal Perception

Although neuroscientists tend to study very simple interactions between neurons, the fact that they've found so many crossmodal areas of the cortex seems to hint that the way we experience the world is fundamentally multimodal. As discussed above, our intuitions about perception are consistent with this; it does not seem as though our perception of events is constrained to the perception of each sensory modality independently. Rather, we perceive a unified world, regardless of the sensory modality through which we perceive it.

It will probably require many more years of research before neuroscientists uncover all the details of the neural machinery involved in this unified experience. In the meantime, experimental psychologists have contributed to our

understanding of multimodal perception through investigations of the behavioral effects associated with it. These effects fall into two broad classes. The first class—**multimodal phenomena**—concerns the binding of inputs from multiple sensory modalities and the effects of this binding on perception. The second class—**crossmodal phenomena**—concerns the influence of one sensory modality on the perception of another (Spence, Senkowski, & Roder, 2009).

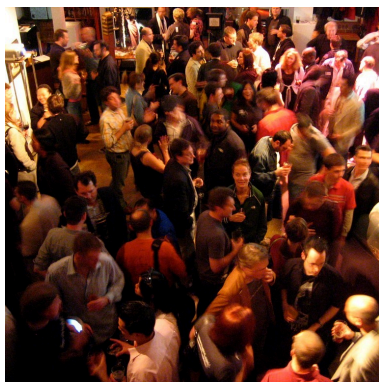
Multimodal Phenomena

Audiovisual Speech

Multimodal phenomena concern stimuli that generate simultaneous (or nearly simultaneous) information in more than one sensory modality. As discussed above, speech is a classic example of this kind of stimulus. When an individual speaks, she generates sound waves that carry meaningful information. If the perceiver is also looking at the speaker, then that perceiver also has access to *visual* patterns that carry meaningful information. Of course, as anyone who has ever tried to lipread knows, there are limits on how informative visual speech information is. Even so, the visual speech pattern alone is sufficient for very robust speech perception. Most people assume that deaf individuals are much better at lipreading than individuals with normal hearing. It may come as a surprise to learn, however, that some individuals with normal hearing are also remarkably good at lipreading (sometimes called “speechreading”). In fact, there is a wide range of speechreading ability in both normal hearing and deaf populations (Andersson, Lyxell, Rönnerberg, & Spens, 2001). However, the reasons for this wide range of performance are

not well understood (Auer & Bernstein, 2007; Bernstein, 2006; Bernstein, Auer, & Tucker, 2001; Mohammed et al., 2005).

How does visual information about speech interact with auditory information about speech? One of the earliest investigations of this question examined the accuracy of recognizing spoken words presented in a noisy context, much like in the example above about talking at a crowded party. To study this phenomenon experimentally, some irrelevant noise (“white noise”—which sounds like a radio tuned between



In a noisy and poorly lit environment such as a nightclub in order to have a conversation we rely on audiovisual speech to understand others. [Image: Jeremy Keith, <https://goo.gl/18sLfg>, CC BY 2.0, <https://goo.gl/v4Y0Zv>]

stations) was presented to participants. Embedded in the white noise were spoken words, and the participants’ task was to identify the words. There were two conditions: one in which only the auditory component of the words was presented (the “auditory-alone” condition), and one in both the auditory and visual components were presented (the “audiovisual” condition). The noise levels were also varied, so that on some trials, the noise was very loud relative to the loudness of the words, and on other trials, the noise was very soft relative to the words. Sumbly and Pollack (1954) found that the accuracy of identifying the spoken words was much higher for the audiovisual condition than it was in the auditory-alone condition. In addition, the pattern of results was consistent with the Principle of Inverse Effectiveness: The advantage gained by audiovisual presentation was highest when the auditory-alone

condition performance was lowest (i.e., when the noise was loudest). At these noise levels, the audiovisual advantage was considerable: It was estimated that allowing the participant to see the speaker was equivalent to turning the volume of the noise down by over half. Clearly, the audiovisual advantage can have dramatic effects on behavior.

Another phenomenon using audiovisual speech is a very famous illusion called the “**McGurk effect**” (named after one of its discoverers). In the classic formulation of the illusion, a movie is recorded of a speaker saying the syllables “gaga.” Another movie is made of the same speaker saying the syllables “baba.” Then, the auditory portion of the “baba” movie is dubbed onto the visual portion of the “gaga” movie. This combined stimulus is presented to participants, who are asked to report what the speaker in the movie said. McGurk and MacDonald (1976) reported that 98 percent of their participants reported hearing the syllable “dada”—which was in neither the visual nor the auditory components of the stimulus. These results indicate that when visual and auditory information about speech is integrated, it can have profound effects on perception.

You can experience the McGurk Effect for yourself here:



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Tactile/Visual Interactions in Body Ownership

Not all multisensory integration phenomena concern speech, however. One particularly compelling multisensory illusion involves the integration of tactile and visual information in the perception of body ownership. In the “**rubber hand illusion**” (Botvinick & Cohen, 1998), an observer is situated so that one of his hands is not visible. A fake rubber hand is placed near the obscured hand, but in a visible location. The experimenter then uses a light paintbrush to simultaneously stroke the obscured hand and the rubber hand in the same locations. For example, if the middle finger of the obscured hand is being brushed, then the middle finger of the rubber hand will also be brushed. This sets up a correspondence between the tactile sensations (coming from the obscured hand) and the visual sensations (of the rubber hand). After a short time (around 10 minutes), participants report feeling as though the rubber hand “belongs” to them; that is, that the rubber hand is a part of their body. This feeling can be so strong that surprising the participant by hitting the rubber hand with a hammer often leads to a reflexive withdrawing of the obscured hand—even though it is in no danger at all. It appears, then, that our awareness of our own bodies may be the result of multisensory integration.

This video demonstrates the experience of the rubber hand illusion:



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<https://ecampusontario.pressbooks.pub/testbookje/?p=2330#oembed-2>

Crossmodal Phenomena

Crossmodal phenomena are distinguished from multimodal phenomena in that they concern the influence one sensory modality has on the perception of another.

Visual Influence on Auditory Localization



Ventriloquists are able to trick us into believing that what we see and what we hear are the same where, in truth, they are not.
[Image: Amanda Ferrell, CC0 Public Domain, <https://goo.gl/m25gce>]

A famous (and commonly experienced) crossmodal illusion is referred to as “the ventriloquism effect.” When a ventriloquist appears to make a puppet speak, she fools the listener into thinking that the location of the origin of the speech sounds is at the puppet’s mouth. In other words, instead of localizing the auditory signal (coming from the mouth of a ventriloquist) to the correct place, our perceptual system localizes it incorrectly (to the mouth of

the puppet).

Why might this happen? Consider the information available to the observer about the location of the two components of the stimulus: the sounds from the ventriloquist's mouth and the visual movement of the puppet's mouth. Whereas it is very obvious where the visual stimulus is coming from (because you can see it), it is much more difficult to pinpoint the location of the sounds. In other words, the very precise visual location of mouth movement apparently overrides the less well-specified location of the auditory information. More generally, it has been found that the location of a wide variety of auditory stimuli can be affected by the simultaneous presentation of a visual stimulus (**Vroomen & De Gelder, 2004**). In addition, the ventriloquism effect has been demonstrated for objects in motion: The motion of a visual object can influence the perceived direction of motion of a moving sound source (**Soto-Faraco, Kingstone, & Spence, 2003**).

Auditory Influence on Visual Perception

A related illusion demonstrates the opposite effect: where sounds have an effect on visual perception. In the **double flash illusion**, a participant is asked to stare at a central point on a computer monitor. On the extreme edge of the participant's vision, a white circle is briefly flashed one time. There is also a simultaneous auditory event: either one beep or two beeps in rapid succession. Remarkably, participants report seeing two visual flashes when the flash is accompanied by two beeps; the same stimulus is seen as a single flash in the context of a single beep or no beep (**Shams, Kamitani, & Shimojo, 2000**). In other words, the number of heard beeps influences the number of seen flashes!

Another illusion involves **the perception of collisions between two circles (called "balls")** moving toward each other

and continuing through each other. Such stimuli can be perceived as either two balls moving through each other or as a collision between the two balls that then bounce off each other in opposite directions. Sekuler, Sekuler, and Lau (1997) showed that the presentation of an auditory stimulus at the time of contact between the two balls strongly influenced the perception of a collision event. In this case, the perceived sound influences the interpretation of the ambiguous visual stimulus.

Crossmodal Speech

Several crossmodal phenomena have also been discovered for speech stimuli. These crossmodal speech effects usually show altered perceptual processing of unimodal stimuli (e.g., acoustic patterns) by virtue of prior experience with the alternate unimodal stimulus (e.g., optical patterns). For example, Rosenblum, Miller, and Sanchez (2007) conducted an experiment examining the ability to become familiar with a person's voice. Their first



Experiments have demonstrated that by simply observing a speaker, with no auditory information, we can gather important clues about the actual sound of their voice. [Ken Whytock, <https://goo.gl/VQJssP>, CC BY-NC 2.0, <https://goo.gl/tgFydH>]

interesting finding was unimodal: Much like what happens when someone repeatedly hears a person speak, perceivers can become familiar with the “visual voice” of a speaker. That is, they can become familiar with the person’s speaking style simply by seeing that person speak. Even more astounding was their crossmodal finding: Familiarity with this

visual information also led to increased recognition of the speaker's *auditory* speech, to which participants had never had exposure.

Similarly, it has been shown that when perceivers see a speaking face, they can identify the (auditory-alone) voice of that speaker, and vice versa (**Kamachi, Hill, Lander, & Vatikiotis-Bateson, 2003; Lachs & Pisoni, 2004a, 2004b, 2004c; Rosenblum, Smith, Nichols, Lee, & Hale, 2006**). In other words, the visual form of a speaker engaged in the act of speaking appears to contain information about what that speaker should sound like. Perhaps more surprisingly, the auditory form of speech seems to contain information about what the speaker should look like.

Conclusion

In this module, we have reviewed some of the main evidence and findings concerning the role of multimodal perception in our experience of the world. It appears that our nervous system (and the cortex in particular) contains considerable architecture for the processing of information arriving from multiple senses. Given this neurobiological setup, and the diversity of behavioral phenomena associated with multimodal stimuli, it is likely that the investigation of multimodal perception will continue to be a topic of interest in the field of experimental perception for many years to come.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily

address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Bouncing balls illusion

The tendency to perceive two circles as bouncing off each other if the moment of their contact is accompanied by an auditory stimulus.

Crossmodal phenomena

Effects that concern the influence of the perception of one sensory modality on the perception of another.

Crossmodal receptive field

A receptive field that can be stimulated by a stimulus from more than one sensory modality.

Crossmodal stimulus

A stimulus with components in multiple sensory modalities that interact with each other.

Double flash illusion

The false perception of two visual flashes when a single flash is accompanied by two auditory beeps.

Integrated

The process by which the perceptual system combines information arising from more than one modality.

McGurk effect

An effect in which conflicting visual and auditory components of a speech stimulus result in an illusory percept.

Multimodal

Of or pertaining to multiple sensory modalities.

Multimodal perception

The effects that concurrent stimulation in more than one sensory modality has on the perception of events and objects in the world.

Multimodal phenomena

Effects that concern the binding of inputs from multiple sensory modalities.

Multisensory convergence zones

Regions in the brain that receive input from multiple unimodal areas processing different sensory modalities.

Multisensory enhancement

See “superadditive effect of multisensory integration.”

Primary auditory cortex

A region of the cortex devoted to the processing of simple auditory information.

Primary visual cortex

A region of the cortex devoted to the processing of simple visual information.

Principle of Inverse Effectiveness

The finding that, in general, for a multimodal stimulus, if the response to each unimodal component (on its own) is weak, then the opportunity for multisensory enhancement is very large. However, if one component—by itself—is sufficient to evoke a strong response, then the effect on the response gained by simultaneously processing the other components of the stimulus will be relatively small.

Receptive field

The portion of the world to which a neuron will respond if an appropriate stimulus is present there.

Rubber hand illusion

The false perception of a fake hand as belonging to a perceiver, due to multimodal sensory information.

Sensory modalities

A type of sense; for example, vision or audition.

Spatial principle of multisensory integration

The finding that the superadditive effects of multisensory

integration are observed when the sources of stimulation are spatially related to one another.

Superadditive effect of multisensory integration

The finding that responses to multimodal stimuli are typically greater than the sum of the independent responses to each unimodal component if it were presented on its own.

Unimodal

Of or pertaining to a single sensory modality.

Unimodal components

The parts of a stimulus relevant to one sensory modality at a time.

Unimodal cortex

A region of the brain devoted to the processing of information from a single sensory modality.

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24. Seeing

Original chapter by Charles Stangor with adaptations by Jennifer Walinga, adapted by the Queen's University Psychology Department

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

You'll notice that this chapter looks a bit different from our earlier chapters. A benefit of an Open Access textbook is that we have the ability to source and adapt content written by experts globally that address issues that are important for our course. This chapter is from the text “Introduction to Psychology–1st Canadian Edition.” You can find the book here.

Learning Objectives

- Identify the key structures of the eye and the role they play in vision.
- Summarize how the eye and the visual cortex work together to sense and perceive the visual stimuli in the environment, including processing colours, shape, depth, and motion

Whereas other animals rely primarily on hearing, smell, or touch to understand the world around them, human beings rely in large part on vision. A large part of our cerebral cortex is

devoted to seeing, and we have substantial visual skills. Seeing begins when light falls on the eyes, initiating the process of transduction. Once this visual information reaches the visual cortex, it is processed by a variety of neurons that detect colours, shapes, and motion, and that create meaningful perceptions out of the incoming stimuli.

The air around us is filled with a sea of **electromagnetic energy**: *pulses of energy waves that can carry information from place to place*. Electromagnetic waves vary in their **wavelength**— *the distance between one wave peak and the next wave peak* — with the shortest gamma waves being only a fraction of a millimeter in length and the longest radio waves being hundreds of kilometers long. Humans are blind to almost all of this energy — *our eyes detect only the range from about 400 to 700 billionths of a meter, the part of the electromagnetic spectrum known as the* **visible spectrum**.

The Sensing Eye and the Perceiving Visual Cortex

As you can see in Figure 5.7, “Anatomy of the Human Eye,” light enters the eye through the **cornea**, *a clear covering that protects the eye and begins to focus the incoming light*. The light then passes through the **pupil**, *a small opening in the centre of the eye*. The pupil is surrounded by the **iris**, *the coloured part of the eye that controls the size of the pupil by constricting or dilating in response to light intensity*. When we enter a dark movie theatre on a sunny day, for instance, muscles in the iris open the pupil and allow more light to enter. Complete adaptation to the dark may take up to 20 minutes.

Behind the pupil is the **lens**, *a structure that focuses the incoming light on the* **retina**, *the layer of tissue at the back of the eye that contains photoreceptor cells*. As our eyes move

from near objects to distant objects, a process known as *visual accommodation* occurs. **Visual accommodation** is the process of changing the curvature of the lens to keep the light entering the eye focused on the retina. Rays from the top of the image strike the bottom of the retina and vice versa, and rays from the left side of the image strike the right part of the retina and vice versa, causing the image on the retina to be upside down and backward. Furthermore, the image projected on the retina is flat, and yet our final perception of the image will be three dimensional.

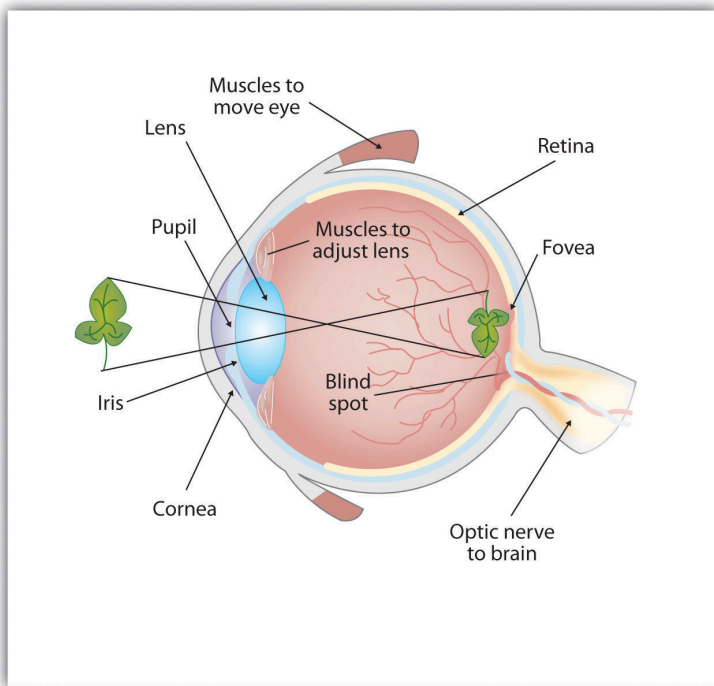


Figure 5.7 Anatomy of the Human Eye. Light enters the eye through the transparent cornea, passing through the pupil at the centre of the iris. The lens adjusts to focus the light on the retina, where it appears upside down and backward. Receptor cells on the retina send information via the optic nerve to the visual cortex.

Accommodation is not always perfect (Figure 5.8) if the focus is in front of the retina, we say that the person is **nearsighted**, and when the focus is behind the retina, we say that the person is **farsighted**. Eyeglasses and contact lenses correct this problem by adding another lens in front of the eye, and laser eye surgery corrects the problem by reshaping the eye's own lens.

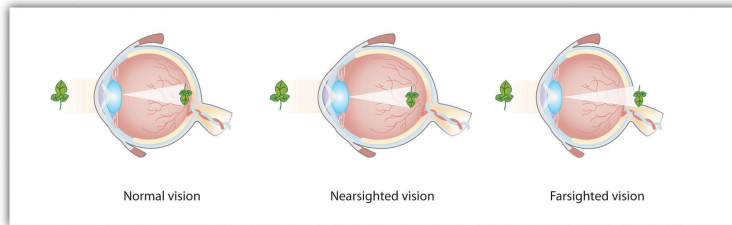


Figure 5.8 Normal, Nearsighted, and Farsighted Eyes. For people with normal vision (left), the lens properly focuses incoming light on the retina. For people who are nearsighted (centre), images from far objects focus too far in front of the retina, whereas for people who are farsighted (right), images from near objects focus too far behind the retina. Eyeglasses solve the problem by adding a secondary, corrective lens.

The retina contains layers of neurons specialized to respond to light (see Figure 5.9, “The Retina with Its Specialized Cells”). As light falls on the retina, it first activates receptor cells known as *rods* and *cones*. The activation of these cells then spreads to the *bipolar cells* and then to the *ganglion cells*, which gather together and converge, like the strands of a rope, forming the *optic nerve*. The **optic nerve** is a collection of millions of ganglion neurons that sends vast amounts of visual information, via the *thalamus*, to the brain. Because the retina and the optic nerve are active processors and analyzers of visual information, it is appropriate to think of these structures as an extension of the brain itself.

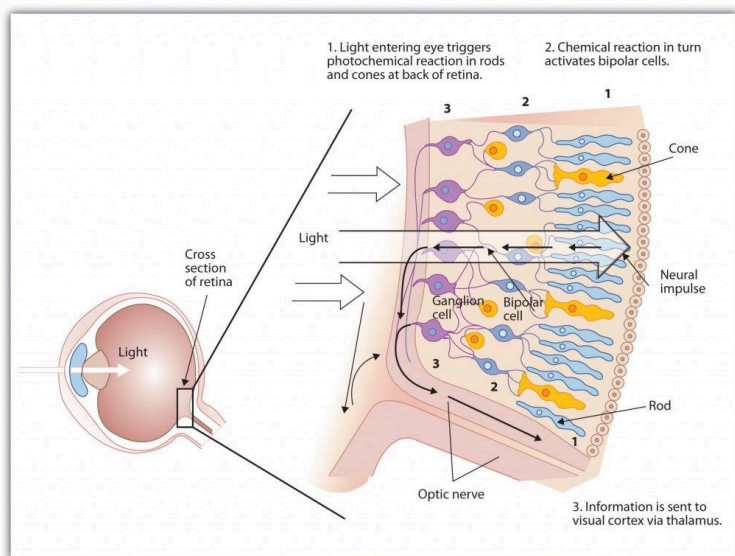


Figure 5.9 The Retina with Its Specialized Cells. When light falls on the retina, it creates a photochemical reaction in the rods and cones at the back of the retina. The reactions then continue to the bipolar cells, the ganglion cells, and eventually to the optic nerve.

Rods are visual neurons that specialize in detecting black, white, and gray colours. There are about 120 million rods in each eye. The rods do not provide a lot of detail about the images we see, but because they are highly sensitive to shorter-waved (darker) and weak light, they help us see in dim light — for instance, at night. Because the rods are located primarily around the edges of the retina, they are particularly active in peripheral vision (when you need to see something at night, try looking away from what you want to see). **Cones** are visual neurons that are specialized in detecting fine detail and colours. The five million or so cones in each eye enable us to see in colour, but they operate best in bright light. The cones are located primarily in and around the **fovea**, which is the central point of the retina.

To demonstrate the difference between rods and cones in attention to detail, choose a word in this text and focus on it. Do you notice that the words a few inches to the side seem more blurred? This is because the word you are focusing on strikes the detail-oriented cones, while the words surrounding it strike the less-detail-oriented rods, which are located on the periphery.

Margaret Livingstone (2000) (Figure 5.10) found an interesting effect that demonstrates the different processing capacities of the eye's rods and cones — namely, that the Mona Lisa's smile, which is widely referred to as “elusive,” is perceived differently depending on how one looks at the painting. Because Leonardo da Vinci painted the smile in low-detail brush strokes, these details are better perceived by our peripheral vision (the rods) than by the cones. Livingstone found that people rated the Mona Lisa as more cheerful when they were instructed to focus on her eyes than they did when they were asked to look directly at her mouth. As Livingstone put it, “She smiles until you look at her mouth, and then it fades, like a dim star that disappears when you look directly at it.”

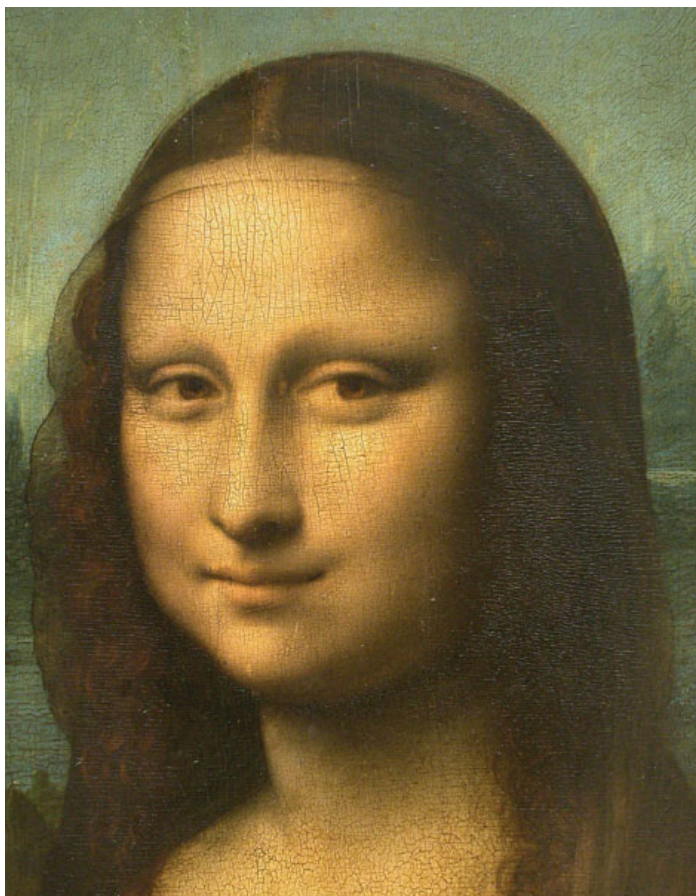


Figure 5.10 Mona Lisa's Smile.

As you can see in Figure 5.11, “Pathway of Visual Images through the Thalamus and into the Visual Cortex,” the sensory information received by the retina is relayed through the thalamus to corresponding areas in the visual cortex, which is located in the occipital lobe at the back of the brain. Although the principle of contralateral control might lead you to expect that the left eye would send information to the right brain

hemisphere and vice versa, nature is smarter than that. In fact, the left and right eyes each send information to both the left and the right hemisphere, and the visual cortex processes each of the cues separately and in parallel. This is an adaptational advantage to an organism that loses sight in one eye, because even if only one eye is functional, both hemispheres will still receive input from it.

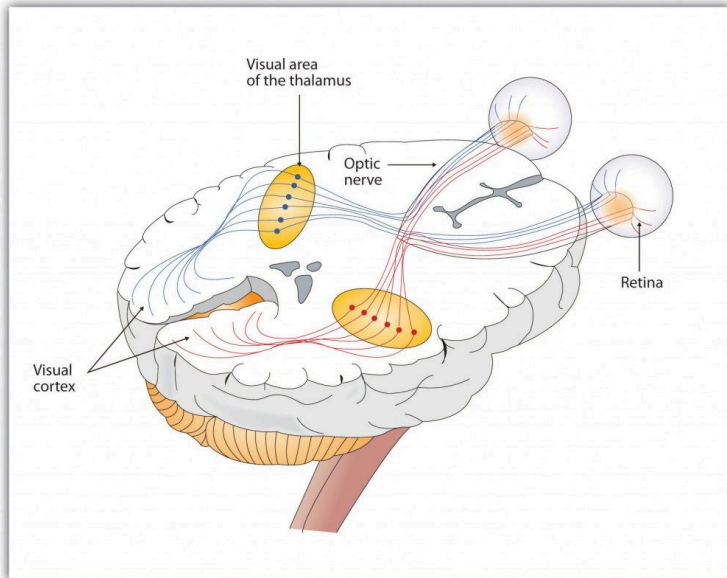


Figure 5.11 Pathway of Visual Images through the Thalamus and into the Visual Cortex. The left and right eyes each send information to both the left and the right brain hemisphere.

The visual cortex is made up of specialized neurons that turn the sensations they receive from the optic nerve into meaningful images. Because there are no photoreceptor cells at the place where the optic nerve leaves the retina, a **hole** or **blind spot** in our vision is created (see Figure 5.12, “Blind Spot Demonstration”). When both of our eyes are open,

we don't experience a problem because our eyes are constantly moving, and one eye makes up for what the other eye misses. But the visual system is also designed to deal with this problem if only one eye is open — the visual cortex simply fills in the small hole in our vision with similar patterns from the surrounding areas, and we never notice the difference. The ability of the visual system to cope with the blind spot is another example of how sensation and perception work together to create meaningful experience.

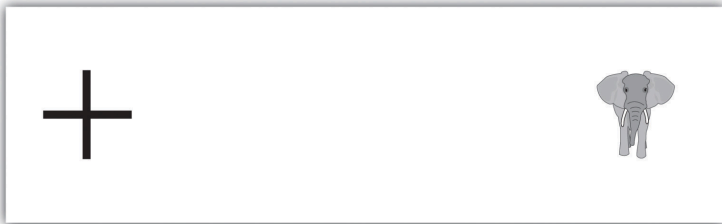


Figure 5.12 Blind Spot Demonstration. You can get an idea of the extent of your blind spot (the place where the optic nerve leaves the retina) by trying this: close your left eye and stare with your right eye at the cross in the diagram. You should be able to see the elephant image to the right (don't look at it, just notice that it is there). If you can't see the elephant, move closer or farther away until you can. Now slowly move so that you are closer to the image while you keep looking at the cross. At one distance (probably a foot or so), the elephant will completely disappear from view because its image has fallen on the blind spot.

Perception is created in part through the simultaneous action of thousands of **feature detector neurons** — *specialized neurons, located in the visual cortex, that respond to the strength, angles, shapes, edges, and movements of a visual stimulus* (Kelsey, 1997; Livingstone & Hubel, 1988). The feature detectors work in parallel, each performing a specialized function. When faced with a red square, for instance, the parallel line feature detectors, the horizontal line feature detectors, and the red colour feature detectors all become

activated. This activation is then passed on to other parts of the visual cortex, where other neurons compare the information supplied by the feature detectors with images stored in memory. Suddenly, in a flash of recognition, the many neurons fire together, creating the single image of the red square that we experience (**Rodriguez et al., 1999**). See Figure 5.13 for an explanation about the Necker cube.

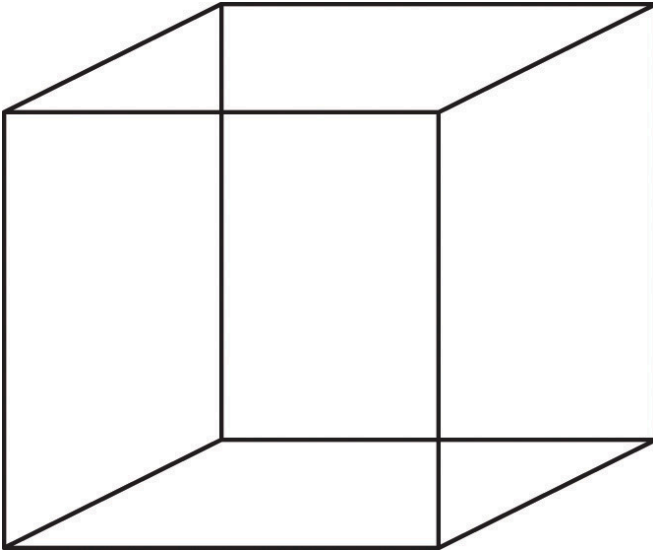


Figure 5.13 The Necker Cube. The Necker cube is an example of how the visual system creates perceptions out of sensations. We do not see a series of lines but, rather, a cube. Which cube we see varies depending on the momentary outcome of perceptual processes in the visual cortex.

Some feature detectors are tuned to selectively respond to particularly important objects, such as faces, smiles, and other parts of the body (**Downing, Jiang, Shuman, & Kanwisher, 2001; Haxby et al., 2001**). When researchers disrupted face recognition areas of the cortex using the magnetic pulses of

transcranial magnetic stimulation (TMS), people were temporarily unable to recognize faces, and yet they were still able to recognize houses (McKone, Kanwisher, & Duchaine, 2007; Pitcher, Walsh, Yovel, & Duchaine, 2007).

Perceiving Colour

It has been estimated that the human visual system can detect and discriminate among seven million colour variations (Geldard, 1972), but these variations are all created by the combinations of the three primary colours: red, green, and blue. *The shade of a colour*, known as **hue**, is conveyed by the wavelength of the light that enters the eye (we see shorter wavelengths as more blue and longer wavelengths as more red), and we detect brightness from the *intensity* or height of the wave (bigger or more intense waves are perceived as brighter).

In his important research on colour vision, Hermann von Helmholtz (1821-1894) theorized that colour is perceived because the cones in the retina come in three types. One type of cone reacts primarily to blue light (short wavelengths), another reacts primarily to green light (medium wavelengths), and a third reacts primarily to red light (long wavelengths). The visual cortex then detects and compares the strength of the signals from each of the three types of cones, creating the experience of colour. According to this Young-Helmholtz **trichromatic colour theory** *what colour we see depends on the mix of the signals from the three types of cones*. If the brain is receiving primarily red and blue signals, for instance, it will perceive purple; if it is receiving primarily red and green signals it will perceive yellow; and if it is receiving messages from all three types of cones it will perceive white.

The different functions of the three types of cones are apparent in people who experience **colour blindness** — *the*

inability to detect green and/or red colours. About one in 50 people, mostly men, lack functioning in the red- or green-sensitive cones, leaving them only able to experience either one or two colours (Figure 5.15).

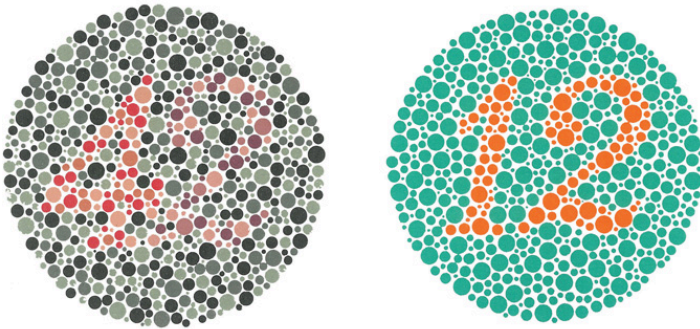


Figure 5.15 Colour Blindness. People with normal colour vision can see the number 42 in the first image and the number 12 in the second (they are vague but apparent). However, people who are colour blind cannot see the numbers at all.

The trichromatic colour theory cannot explain all of human vision, however. For one, although the colour purple does appear to us as a mix of red and blue, yellow does not appear to be a mix of red and green. And people with colour blindness, who cannot see either green or red, nevertheless can still see yellow. An alternative approach to the Young-Helmholtz theory, known as the **opponent-process colour theory**, proposes that we analyze sensory information not in terms of three colours but rather in three sets of “opponent colours”: red-green, yellow-blue, and white-black. Evidence for the opponent-process theory comes from the fact that some neurons in the retina and in the visual cortex are excited by one colour (e.g., red) but inhibited by another colour (e.g., green).

One example of opponent processing occurs in the experience of an afterimage. If you stare at the shape on the top left side of Figure 5.16, “Afterimages,” for about 30 seconds (the longer you look, the better the effect), and then move your eyes to the blank area to the right of it, you will see the afterimage. Now try this by staring at the image of the Italian flag below and then shifting your eyes to the blank area beside it. When we stare at the green stripe, our green receptors habituate and begin to process less strongly, whereas the red receptors remain at full strength. When we switch our gaze, we see primarily the red part of the opponent process. Similar processes create blue after yellow and white after black.

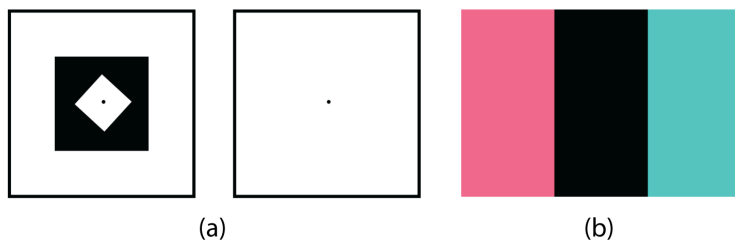


Figure 5.16 Afterimages.

The tricolour and the opponent-process mechanisms work together to produce colour vision. When light rays enter the eye, the red, blue, and green cones on the retina respond in different degrees and send different strength signals of red, blue, and green through the optic nerve. The colour signals are then processed both by the ganglion cells and by the neurons in the visual cortex (**Gegenfurtner & Kiper, 2003**).

Perceiving Form

One of the important processes required in vision is the perception of form. German psychologists in the 1930s and 1940s, including Max Wertheimer (1880-1943), Kurt Koffka (1886-1941), and Wolfgang Köhler (1887-1967), argued that we create forms out of their component sensations based on the idea of the **gestalt**, *a meaningfully organized whole*. The idea of the gestalt is that the “whole is more than the sum of its parts.” Some examples of how gestalt principles lead us to see more than what is actually there are summarized in Table 5.1, “Summary of Gestalt Principles of Form Perception.”

Table 5.1 Summary of Gestalt Principles of Form Perception.

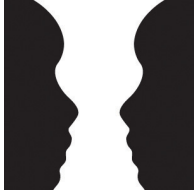




Principle	Description	Example	Image
Figure and ground	We structure input so that we always see a figure (image) against a ground (background).	At right, you may see a vase or you may see two faces, but in either case, you will organize the image as a figure against a ground.	
Similarity	Stimuli that are similar to each other tend to be grouped together.	You are more likely to see three similar columns among the XYX characters at right than you are to see four rows.	
Proximity	We tend to group nearby figures together.	Do you see four or eight images at right? Principles of proximity suggest that you might see only four.	
Continuity	We tend to perceive stimuli in smooth, continuous ways rather than in more discontinuous ways.	At right, most people see a line of dots that moves from the lower left to the upper right, rather than a line that moves from the left and then suddenly turns down. The principle of continuity leads us to see most lines as following the smoothest possible path.	
Closure	We tend to fill in gaps in an incomplete image to create a complete, whole object.	Closure leads us to see a single spherical object at right rather than a set of unrelated cones.	

Table 5.1 Summary of Gestalt Principles of Form Perception.

Depth perception is the ability to perceive three-dimensional space and to accurately judge distance. Without depth perception, we would be unable to drive a car, thread a needle, or simply navigate our way around the supermarket (**Howard & Rogers, 2001**). Research has found that depth perception is in part based on innate capacities and in part learned through experience (**Witherington, 2005**).

Perceiving Depth

Psychologists Eleanor Gibson and Richard Walk (**1960**) tested the ability to perceive depth in six- to 14-month-old infants by placing them on a **visual cliff**, *a mechanism that gives the perception of a dangerous drop-off, in which infants can be safely tested for their perception of depth* (Figure 5.17 “Visual Cliff”). The infants were placed on one side of the “cliff,” while their mothers called to them from the other side. Gibson and Walk found that most infants either crawled away from the cliff or remained on the board and cried because they wanted to go to their mothers, but the infants perceived a chasm that they instinctively could not cross. Further research has found that even very young children who cannot yet crawl are fearful of heights (**Campos, Langer, & Krowitz, 1970**). On the other hand, studies have also found that infants improve their hand-eye coordination as they learn to better grasp objects and as they gain more experience in crawling, indicating that depth perception is also learned (**Adolph, 2000**).



Figure 5.17 Visual Cliff. Babies appear to have the innate ability to perceive depth, as seen by this baby's reluctance to cross the "visual cliff."

Depth perception is the result of our use of **depth cues**, messages from our bodies and the external environment that supply us with information about space and distance. **Binocular depth cues** are depth cues that are created by retinal image disparity — that is, the space between our eyes — and which thus require the coordination of both eyes. One outcome of retinal disparity is that the images projected on each eye are slightly different from each other. The visual cortex automatically merges the two images into one, enabling us to perceive depth. Three-dimensional movies make use of retinal disparity by using 3-D glasses that the viewer wears to create a different image on each eye. The perceptual system quickly, easily, and unconsciously turns the disparity into 3-D.

An important binocular depth cue is **convergence**, *the inward turning of our eyes that is required to focus on objects that are less than about 50 feet away from us*. The visual cortex uses the size of the convergence angle between the eyes to judge the object's distance. You will be able to feel your eyes converging if you slowly bring a finger closer to your nose while continuing to focus on it. When you close one eye, you no longer feel the tension — convergence is a binocular depth cue that requires both eyes to work.

The visual system also uses **accommodation** to *help determine depth*. As the lens changes its curvature to focus on distant or close objects, information relayed from the muscles attached to the lens helps us determine an object's distance. Accommodation is only effective at short viewing distances, however, so while it comes in handy when threading a needle or tying shoelaces, it is far less effective when driving or playing sports.

Although the best cues to depth occur when both eyes work together, we are able to see depth even with one eye closed. **Monocular depth cues** are *depth cues that help us perceive depth using only one eye* (Sekuler & Blake, 2006). Some of the most important are summarized in Table 5.2, “Monocular Depth Cues That Help Us Judge Depth at a Distance.”

Table 5.2 Monocular Depth Cues That

Name	Description	E
Position	We tend to see objects higher up in our field of vision as farther away.	T k h
Relative size	Assuming that the objects in a scene are the same size, smaller objects are perceived as farther away.	A n

Name	Description
Linear perspective	Parallel lines appear to converge at a distance.

Name

Description

Light and shadow

The eye receives more reflected light from objects that are closer to us. Normally, light comes from above, so darker images are in shadow.

Name

Description

Interposition

When one object overlaps another object, we view it as closer.

Name	Description
Aerial perspective	Objects that appear hazy, or that are covered with smog or dust, appear farther away.

Perceiving Motion

Many animals, including human beings, have very sophisticated perceptual skills that allow them to coordinate their own motion with the motion of moving objects in order to create a collision with that object. Bats and birds use this mechanism to catch up with prey, dogs use it to catch a

Frisbee, and humans use it to catch a moving football. The brain detects motion partly from the changing size of an image on the retina (objects that look bigger are usually closer to us) and in part from the relative brightness of objects.

We also experience motion when objects near each other change their appearance. The **beta effect** refers to *the perception of motion that occurs when different images are presented next to each other in succession* (see “Beta Effect and Phi Phenomenon”). The visual cortex fills in the missing part of the motion and we see the object moving. The beta effect is used in movies to create the experience of motion. A related effect is the **phi phenomenon**, in which *we perceive a sensation of motion caused by the appearance and disappearance of objects that are near each other*. The phi phenomenon looks like a moving zone or cloud of background colour surrounding the flashing objects. The beta effect and the phi phenomenon are other examples of the importance of the gestalt — our tendency to “see more than the sum of the parts.”

Beta Effect and Phi Phenomenon

In the beta effect, our eyes detect motion from a series of still images, each with the object in a different place. This is the fundamental mechanism of motion pictures (movies). In the phi phenomenon, the perception of motion is based on the momentary hiding of an image.

Phi phenomenon: <http://upload.wikimedia.org/wikipedia/commons/6/6e/Lilac-Chaser.gif>

Beta effect: http://upload.wikimedia.org/wikipedia/commons/0/09/Phi_phenomenom_no_watermark.gif

Key Takeaways

- Vision is the process of detecting the electromagnetic energy that surrounds us. Only a small fraction of the electromagnetic spectrum is visible to humans.
- The visual receptor cells on the retina detect shape, colour, motion, and depth.
- Light enters the eye through the transparent cornea and passes through the pupil at the centre of the iris. The lens adjusts to focus the light on the retina, where it appears upside down and backward. Receptor cells on the retina are excited or inhibited by the light and send information to the visual cortex through the optic nerve.
- The retina has two types of photoreceptor cells: rods, which detect brightness and respond to black and white, and cones, which respond to red, green, and blue. Colour blindness occurs when people lack function in the red- or green-sensitive cones.
- Feature detector neurons in the visual cortex help us recognize objects, and some neurons respond selectively to faces and other body parts.
- The Young-Helmholtz trichromatic colour

theory proposes that colour perception is the result of the signals sent by the three types of cones, whereas the opponent-process colour theory proposes that we perceive colour as three sets of opponent colours: red-green, yellow-blue, and white-black.

- The ability to perceive depth occurs as the result of binocular and monocular depth cues.
- Motion is perceived as a function of the size and brightness of objects. The beta effect and the phi phenomenon are examples of perceived motion.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Accommodation

Helps determine depth.

Beta effect

The perception of motion that occurs when different images are presented next to each other in succession

Binocular depth cues

Depth cues that are created by retinal image disparity — that is, the space between our eyes — and which thus require the coordination of both eyes

Blind spot

A hole in our vision because there are no photoreceptor cells at the place where the optic nerve leaves the retina

Colour blindness

The inability to detect green and/or red colours

Cones

Visual neurons that are specialized in detecting fine detail and colours

Convergence

The inward turning of our eyes that is required to focus on objects that are less than about 50 feet away from us

Cornea

A clear covering that protects the eye and begins to focus the incoming light

Depth cues

Messages from our bodies and the external environment that supply us with information about space and distance.

Electromagnetic energy

Pulses of energy waves that can carry information from place to place

Farsighted

When the focus is behind the retina

Feature detector neurons

Specialized neurons, located in the visual cortex, that respond to the strength, angles, shapes, edges, and movements of a visual stimulus

Fovea

The central point of the retina

Gestalt

A meaningfully organized whole

Hue

The shade of a colour

Iris

The coloured part of the eye that controls the size of the pupil by constricting or dilating in response to light intensity

Lens

A structure that focuses the incoming light on the retina

Monocular depth cues

Depth cues that help us perceive depth using only one eye

Nearsighted

When the focus is in front of the retina

Opponent-process colour theory

Proposes that we analyze sensory information not in terms of three colours but rather in three sets of “opponent colours”: red-green, yellow-blue, and white-black

Optic nerve

A collection of millions of ganglion neurons that sends vast amounts of visual information, via the thalamus, to the brain

Phi phenomenon

We perceive a sensation of motion caused by the appearance and disappearance of objects that are near each other

Pupil

A small opening in the centre of the eye

Retina

The layer of tissue at the back of the eye that contains photoreceptor cells

Rods

Visual neurons that specialize in detecting black, white, and gray colours

Trichromatic colour theory

The colour we see depends on the mix of the signals from the three types of cones

Visible spectrum

The part of the electromagnetic spectrum that our eyes detect (only the range from about 400 to 700 billionths of a meter)

Visual accommodation

The process of changing the curvature of the lens to keep the light entering the eye focused on the retina

Visual cliff

A mechanism that gives the perception of a dangerous drop-off, in which infants can be safely tested for their perception of depth

Wavelength

The distance between one wave peak and the next wave peak

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PSYC 100 IX

CONSCIOUSNESS AND SLEEP

25. Consciousness

Original chapter by Ken Paller and Saturo Suzuki adapted by the Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

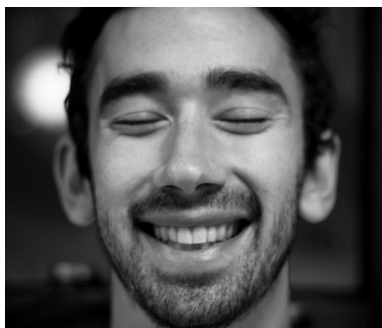
Consciousness is the ultimate mystery. What is it and why do we have it? These questions are difficult to answer, even though consciousness is so fundamental to our existence. Perhaps the natural world could exist largely as it is without human consciousness; but taking away consciousness would essentially take away our humanity. Psychological science has addressed questions about consciousness in part by distinguishing neurocognitive functions allied with conscious experience from those that transpire without conscious experience. The continuing investigation of these sorts of distinctions is yielding an empirical basis for new hypotheses about the precursors of conscious experience. Richer conceptualizations are thus being built, combining first-person and third-person perspectives to provide new clues to the mystery of consciousness.

Learning Objectives

- Understand scientific approaches to comprehending consciousness.
- Be familiar with evidence about human vision, memory, body awareness, and decision making relevant to the study of consciousness.
- Appreciate some contemporary theories about consciousness.

Conscious Experiences

Contemplate the unique experience of being you at this moment! You, and only you, have direct knowledge of your own conscious experiences. At the same time, you cannot know consciousness from anyone else's inside view. How can we begin to understand this fantastic ability to have private, conscious experiences?



At the most basic level all of conscious experience is unique to each individual. [Image: Étienne Ljóni Poisson, <https://goo.gl/mbo5VJ>, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

In a sense, everything you know is from your own vantage point, with your own consciousness at the center. Yet the scientific study of consciousness confronts the challenge of producing general understanding that goes beyond what can be known from one individual's perspective.

To delve into this topic, some terminology must first be considered. The

term *consciousness* can denote the ability of a person to generate a series of conscious experiences one after another. Here we include experiences of feeling and understanding sensory input, of a temporal sequence of autobiographical events, of imagination, of emotions and moods, of ideas, of memories—the whole range of mental contents open to an individual.

Consciousness can also refer to the state of an individual, as in a sharp or dull state of consciousness, a drug-induced state such as euphoria, or a diminished state due to drowsiness, sleep, neurological abnormality, or coma. In this module, we focus not on states of consciousness or on self-consciousness, but rather on the process that unfolds in the course of a **conscious experience**—a moment of **awareness**—the essential ingredient of consciousness.

Other Minds

You have probably experienced the sense of knowing exactly what a friend is thinking. Various signs can guide our inferences about consciousness in others. We can try to infer what's going on in someone else's mind by relying on the assumption that they feel what we imagine we would feel in the same situation. We might account for someone's actions or emotional expressions through our knowledge of that individual and our careful observations of their behavior. In this way, we often display substantial insight into what they are thinking. Other times we are completely wrong.

By measuring brain activity using various neuroscientific technologies, we can acquire additional information useful for deciphering another person's state of mind. In special circumstances such inferences can be highly accurate, but limitations on mind reading remain, highlighting the difficulty of understanding exactly how conscious experiences arise.

A Science of Consciousness

Attempts to understand consciousness have been pervasive throughout human history, mostly dominated by philosophical analyses focused on the **first-person perspective**. Now we have a wider set of approaches that includes philosophy, psychology, neuroscience, cognitive science, and **contemplative science** (Blackmore, 2006; Koch, 2012; Zelazo, Moscovitch, & Thompson, 2007; Zeman, 2002).

The challenge for this combination of approaches is to give a comprehensive explanation of consciousness. That explanation would include describing the benefits of consciousness, particularly for behavioral capabilities that conscious experiences allow, that trump automatic behaviors. Subjective experiences also need to be described in a way that logically shows how they result from precursor events



Consciousness is a topic that has been addressed by religious scholars, philosophers, psychologists, and neuroscientists. [Image: CC0 Public Domain, <https://goo.gl/m25gce>]

in the human brain. Moreover, a full account would describe how consciousness depends on biological, environmental, social, cultural, and developmental factors.

At the outset, a central question is how to conceive of consciousness relative to other things we know. Objects in our environment have a physical basis and are understood to be composed of constituents, such that they can be broken down into molecules, elements, atoms, particles, and so on. Yet we can also understand things relationally and conceptually. Sometimes a phenomenon can best be conceived as a process

rather than a physical entity (e.g., digestion is a process whereby food is broken down). What, then, is the relationship between our conscious thoughts and the physical universe, and in particular, our brains?

Rene Descartes' position, *dualism*, was that mental and physical are, in essence, different substances. This view can be contrasted with *reductionist* views that mental phenomena can be explained via descriptions of physical phenomena. Although the dualism/reductionism debate continues, there are many ways in which mind can be shown to depend on brain.

A prominent orientation to the scientific study of consciousness is to seek understanding of these dependencies—to see how much light they can shed on consciousness. Significant advances in our knowledge about consciousness have thus been gained, as seen in the following examples.

Conscious Experiences of Visual Perception

Suppose you meet your friend at a crowded train station. You may notice a subtle smile on her face. At that moment you are probably unaware of many other things happening within your view. What makes you aware of some things but not others? You probably have your own intuitions about this, but experiments have proven wrong many common intuitions about what generates visual awareness.

For instance, you may think that if you attentively look at a bright spot, you must be aware of it. Not so. In a phenomenon known as motion-induced blindness, bright discs completely vanish from your awareness in full attention. To experience this

for yourself, see this module's Outside Resource section for a demonstration of motion-induced blindness.



Are you really aware of everything that is going on around you? In the context of a crowded train station you may be visually aware of certain things while essentially being blind to many others that are right in front of you. [Image: Diego Torres Silvestre, <https://goo.gl/ZkCWEC>, CC BY 2.0, <https://goo.gl/BRvSA7>]

You may think that if you deeply analyze an image, decoding its meaning and making a decision about it, you must be aware of the image. Not necessarily. When a number is briefly flashed and rapidly replaced by a random pattern, you may have no awareness of it, despite the fact that your brain allows you to determine that the number is greater than 5, and then prepare your right hand for a key press if that is what you were instructed to do (Dehaene et al., 1998).

Thus, neither the brightness of an image, paying full attention to it, nor deeply analyzing it guarantees that you will be aware of it. What, then, is the crucial ingredient of visual awareness?

A contemporary answer is that our awareness of a visual feature depends on a certain type of reciprocal exchange of information across multiple brain areas, particularly in the cerebral cortex. In support of this idea, directly activating your visual motion area (known as V5) with an externally applied magnetic field (*transcranial magnetic stimulation*) will make you see moving dots. This is not surprising. What is surprising is that activating your visual motion area alone does not let you see motion. You will not see moving dots if the feedback signal from V5 to the primary visual cortex is disrupted by a further transcranial magnetic stimulation pulse (Pascual-Leone &

Walsh, 2001). The reverberating reciprocal exchange of information between higher-level visual areas and primary visual cortex appears to be essential for generating visual awareness.

This idea can also explain why people with certain types of brain damage lack visual awareness. Consider a patient with brain damage limited to primary visual cortex who claims not to see anything — a problem termed *cortical blindness*. Other areas of visual cortex may still receive visual input through projections from brain structures such as the thalamus and superior colliculus, and these networks may mediate some preserved visual abilities that take place without awareness. For example, a patient with cortical blindness might detect moving stimuli via V5 activation but still have no conscious experiences of the stimuli, because the reverberating reciprocal exchange of information cannot take place between V5 and the damaged primary visual cortex. The preserved ability to detect motion might be evident only when a guess is required (“guess whether something moved to the left or right”)—otherwise the answer would be “I didn’t see anything.” This phenomenon of blindsight refers to blindness due to a neurological cause that preserves abilities to analyze and respond to visual stimuli that are not consciously experienced (**Lamme, 2001**).

If exchanges of information across brain areas are crucial for generating visual awareness, neural synchronization must play an important role because it promotes neural communication. A neuron’s excitability varies over time. Communication among neural populations is enhanced when their oscillatory cycles of excitability are synchronized. In this way, information transmitted from one population in its excitable phase is received by the target population when it is also in its excitable phase. Indeed, oscillatory neural synchronization in the beta- and gamma-band frequencies (identified according to the number of oscillations per second, 13–30 Hz and 30–100 Hz,

respectively) appears to be closely associated with visual awareness. This idea is highlighted in the *Global Neuronal Workspace Theory of Consciousness* (**Dehaene & Changeux, 2011**), in which sharing of information among prefrontal, inferior parietal, and occipital regions of the cerebral cortex is postulated to be especially important for generating awareness.

A related view, the *Information Integration Theory of Consciousness*, is that shared information itself constitutes consciousness (**Tononi, 2004**). An organism would have minimal consciousness if the structure of shared information is simple, whereas it would have rich conscious experiences if the structure of shared information is complex. Roughly speaking, complexity is defined as the number of intricately interrelated informational units or ideas generated by a web of local and global sharing of information. The degree of consciousness in an organism (or a machine) would be high if numerous and diversely interrelated ideas arise, low if only a few ideas arise or if there are numerous ideas but they are random and unassociated. Computational analyses provide additional perspectives on such proposals. In particular, if every neuron is connected to every other neuron, all neurons would tend to activate together, generating few distinctive ideas. With a very low level of neuronal connectivity at the other extreme, all neurons would tend to activate independently, generating numerous but unassociated ideas. To promote a rich level of consciousness, then, a suitable mixture of short-, medium-, and long-range neural connections would be needed. The human cerebral cortex may indeed have such an optimum structure of neural connectivity. Given how consciousness is conceptualized in this theory as graded rather than all-or-none, a quantitative approach (e.g., **Casali et al., 2013; Monti et al., 2013**) could conceivably be used to estimate the level of consciousness in nonhuman species and artificial beings.

Conscious Experiences of Memory

The pinnacle of conscious human memory functions is known as episodic recollection because it allows one to reexperience the past, to virtually relive an earlier event. People who suffer from amnesia due to neurological damage to certain critical brain areas have poor memory for events and facts. Their memory deficit disrupts the type of memory termed *declarative memory* and makes it difficult to consciously remember. However, amnesic insults typically spare a set of memory functions that do not involve conscious remembering. These other types of memory, which include various habits, motor skills, cognitive skills, and procedures, can be demonstrated when an individual executes various actions as a function of prior learning, but in these cases a conscious experience of remembering is not necessarily included.



Research on amnesia has thus supported the proposal that conscious remembering requires a specific set of brain operations that depend on networks of neurons in the cerebral cortex. Some of the other types of memory involve only subcortical brain regions, but there are also notable exceptions. In particular, *perceptual priming* is a type of memory that does not entail the conscious experience of remembering and that is typically preserved in amnesia. Perceptual priming is thought to reflect a fluency of processing produced by a prior experience, even when the individual cannot remember that prior experience. For example, a word or face might be perceived more efficiently if it had been viewed minutes earlier than if it hadn't. Whereas a person with amnesia can

demonstrate this item-specific fluency due to changes in corresponding cortical areas, they nevertheless would be impaired if asked to recognize the words or faces they previously experienced. A reasonable conclusion on the basis of this evidence is that remembering an episode is a conscious experience not merely due to the involvement of one portion of the cerebral cortex, but rather due to the specific configuration of cortical activity involved in the sharing or integration of information.

Further neuroscientific studies of memory retrieval have shed additional light on the necessary steps for conscious recollection. For example, storing memories for the events we experience each day appears to depend on connections among multiple cortical regions as well as on a brain structure known as the hippocampus. Memory storage becomes more secure due to interactions between the hippocampus and cerebral cortex that can transpire over extended time periods following the initial registration of information. Conscious retrieval thus depends on the activity of elaborate sets of networks in the cortex. Memory retrieval that does not include conscious recollection depends either on restricted portions of the cortex or on brain regions separate from the cortex.

The ways in which memory expressions that include the awareness of remembering differ from those that do not thus highlight the special nature of conscious memory experiences (**Paller, Voss, & Westerberg, 2009; Voss, Lucas, & Paller, 2012**). Indeed, memory storage in the brain can be very complex for many different types of memory, but there are specific physiological prerequisites for the type of memory that coincides with conscious recollection.

Conscious Experiences of Body Awareness

The brain can generate body awareness by registering

coincident sensations. For example, when you rub your arm, you see your hand rubbing your arm and simultaneously feel the rubbing sensation in both your hand and your arm. This simultaneity tells you that it is *your* hand and *your* arm. Infants use the same type of coincident sensations to initially develop the self/nonself distinction that is fundamental to our construal of the world.

The fact that your brain constructs body awareness in this way can be experienced via the rubber-hand illusion (see Outside Resource on this). If you see a rubber hand being rubbed and simultaneously feel the corresponding rubbing sensation on your own body out of view, you will momentarily feel a bizarre sensation—that the rubber hand is your own.

The construction of our body awareness appears to be mediated by specific brain mechanisms involving a region of the cortex known as the temporoparietal junction. Damage to this brain region can generate distorted body awareness, such as feeling a substantially elongated torso. Altered neural activity in this region through artificial stimulation can also produce an out-of-body experience (see this module's Outside Resources section), in which you feel like your body is in another location and you have a novel perspective on your body and the world, such as from the ceiling of the room.

Remarkably, comparable brain mechanisms may also generate the normal awareness of the sense of self and the sensation of being inside a body. In the context of *virtual reality* this sensation is known as *presence* (the compelling experience of actually being there). Our normal localization of the self may be equally artificial, in that it is not a given aspect of life but is constructed through a special brain mechanism.

A Social Neuroscience Theory of Consciousness (**Graziano & Kastner, 2011**) ascribes an important role to our ability to localize our own sense of self. The main premise of the theory is that you fare better in a social environment to the extent that you can predict what people are going to do. So, the human

brain has developed mechanisms to construct models of other people's attention and intention, and to localize those models in the corresponding people's heads to keep track of them. The proposal is that the same brain mechanism was adapted to construct a model of one's own attention and intention, which is then localized in one's own head and perceived as consciousness. If so, then the primary function of consciousness is to allow us to predict our own behavior. Research is needed to test the major predictions of this new theory, such as whether changes in consciousness (e.g., due to normal fluctuations, psychiatric disease, brain damage) are closely associated with changes in the brain mechanisms that allow us to model other people's attention and intention.

Conscious Experiences of Decision Making

Choosing among multiple possible actions, the sense of *volition*, is closely associated with our subjective feeling of consciousness. When we make a lot of decisions, we may feel especially conscious and then feel exhausted, as if our mental energy has been drained.

We make decisions in two distinct ways. Sometimes we carefully analyze and weigh different factors to reach a decision, taking full advantage of the brain's conscious mode of information processing. Other times we make a *gut decision*, trusting the unconscious mode of information processing (although it still depends on the brain). The unconscious mode is adept at



When making a decision you might carefully consider your choices or simply “go with your gut”. [Image: Daniel Lee, <https://goo.gl/aJi3jx>, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

simultaneously considering numerous factors in parallel, which can yield an overall impression of the sum total of evidence. In this case, we have no awareness of the individual considerations. In the conscious mode, in contrast, we can carefully scrutinize each factor—although the act of focusing on a specific factor can interfere with weighing in other factors.

One might try to optimize decision making by taking into account these two strategies. A careful conscious decision should be effective when there are only a few known factors to consider. A gut decision should be effective when a large number of factors should be considered simultaneously. Gut decisions can indeed be accurate on occasion (e.g., guessing which of many teams will win a close competition), but only if you are well versed in the relevant domain (**Dane, Rockmann, & Pratt, 2012**).

As we learn from our experiences, some of this gradual knowledge accrual is unconscious; we don't know we have it and we can use it without knowing it. On the other hand, consciously acquired information can be uniquely beneficial by allowing additional stages of control (**de Lange, van Gaal,**

Lamme, & Dehaene, 2011). It is often helpful to control which new knowledge we acquire and which stored information we retrieve in accordance with our conscious goals and beliefs.

Whether you choose to trust your gut or to carefully analyze the relevant factors, you feel that you freely reach your own decision. Is this feeling of free choice real? Contemporary experimental techniques fall short of answering this existential question. However, it is likely that at least the sense of immediacy of our decisions is an illusion.

In one experiment, people were asked to freely consider whether to press the right button or the left button, and to press it when they made the decision (**Soon, Brass, Heinze, & Haynes, 2008**). Although they indicated that they made the decision immediately before pressing the button, their brain activity, measured using functional magnetic resonance imaging, predicted their decision as much as 10 seconds before they said they freely made the decision. In the same way, each conscious experience is likely preceded by precursor brain events that on their own do not entail consciousness but that culminate in a conscious experience.

In many situations, people generate a reason for an action that has nothing to do with the actual basis of the decision to act in a particular way. We all have a propensity to retrospectively produce a reasonable explanation for our behavior, yet our behavior is often the result of unconscious mental processing, not conscious volition.

Why do we feel that each of our actions is immediately preceded by our own decision to act? This illusion may help us distinguish our own actions from those of other agents. For example, while walking hand-in-hand with a friend, if you felt you made a decision to turn left immediately before you both turned left, then you know that you initiated the turn; otherwise, you would know that your friend did.

Even if some aspects of the decision-making process are illusory, to what extent are our decisions determined by prior

conditions? It certainly seems that we can have full control of some decisions, such as when we create a conscious intention that leads to a specific action: You can decide to go left or go right. To evaluate such impressions, further research must develop a better understanding of the neurocognitive basis of volition, which is a tricky undertaking, given that decisions are conceivably influenced by unconscious processing, neural noise, and the unpredictability of a vast interactive network of neurons in the brain.

Yet belief in free choice has been shown to promote moral behavior, and it is the basis of human notions of justice. The sense of free choice may be a beneficial trait that became prevalent because it helped us flourish as social beings.

Understanding Consciousness

Our human consciousness unavoidably colors all of our observations and our attempts to gain understanding. Nonetheless, scientific inquiries have provided useful perspectives on consciousness. The advances described above should engender optimism about the various research strategies applied to date and about the prospects for further insight into consciousness in the future.



Because conscious experiences are inherently private, they have sometimes been taken to be outside the realm of scientific inquiry. This view idealizes science as an endeavor involving only observations that can be verified by multiple observers, relying entirely on the **third-person**

perspective, or the view from nowhere (from no particular perspective). Yet conducting science is a human activity that depends, like other human activities, on individuals and their subjective experiences. A rational scientific account of the world cannot avoid the fact that people have subjective experiences.

Subjectivity thus has a place in science. Conscious experiences can be subjected to systematic analysis and empirical tests to yield progressive understanding. Many further questions remain to be addressed by scientists of the future. Is the first-person perspective of a conscious experience basically the same for all human beings, or do individuals differ fundamentally in their introspective experiences and capabilities? Should psychological science focus only on ordinary experiences of consciousness, or are extraordinary experiences also relevant? Can training in introspection lead to a specific sort of expertise with respect to conscious experience? An individual with training, such as through extensive meditation practice, might be able to describe their experiences in a more precise manner, which could then support improved characterizations of consciousness. Such a person might be able to understand subtleties of experience that other individuals fail to notice, and thereby move our understanding of consciousness significantly forward. These and other possibilities await future scientific inquiries into consciousness.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To

promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Awareness

A conscious experience or the capability of having conscious experiences, which is distinct from self-awareness, the conscious understanding of one's own existence and individuality.

Conscious experience

The first-person perspective of a mental event, such as feeling some sensory input, a memory, an idea, an emotion, a mood, or a continuous temporal sequence of happenings.

Contemplative science

A research area concerned with understanding how

contemplative practices such as meditation can affect individuals, including changes in their behavior, their emotional reactivity, their cognitive abilities, and their brains. Contemplative science also seeks insights into conscious experience that can be gained from first-person observations by individuals who have gained extraordinary expertise in introspection.

First-person perspective

Observations made by individuals about their own conscious experiences, also known as introspection or a subjective point of view. Phenomenology refers to the description and investigation of such observations.

Third-person perspective

Observations made by individuals in a way that can be independently confirmed by other individuals so as to lead to general, objective understanding. With respect to consciousness, third-person perspectives make use of behavioral and neural measures related to conscious experiences.

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26. States of Consciousness

Original chapter by Robert Biswas-Diener
and Jake Teeny adapted by the Queen's
University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

No matter what you're doing—solving homework, playing a video game, simply picking out a shirt—all of your actions and decisions relate to your consciousness. But as frequently as we use it, have you ever stopped to ask yourself: What really is consciousness? In this module, we discuss the different levels of consciousness and how they can affect your behavior in a variety of situations. As well, we explore the role of consciousness in other, “altered” states like hypnosis and sleep.

Learning Objectives

- Define consciousness and distinguish between high and low conscious states
- Explain the relationship between consciousness and bias
- Understand the difference between popular portrayals of

Introduction

Have you ever had a fellow motorist stopped beside you at a red light, singing his brains out, or picking his nose, or otherwise behaving in ways he might not normally do in public? There is something about being alone in a car that encourages people to zone out and forget that others can see them. Although these little lapses of attention are amusing for the rest of us, they are also instructive when it comes to the topic of consciousness



This guy is singing his heart out in his one-man mobile music studio. Have you ever done this? [Image: Joshua Ommen, <https://goo.gl/Za97c3>, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

Consciousness is a term meant to indicate awareness. It includes awareness of the self, of bodily sensations, of thoughts and of the environment. In English, we use the opposite word “unconscious” to indicate senselessness or a barrier to awareness, as in the case of “Theresa fell off the ladder and hit her head, knocking herself unconscious.” And yet, psychological theory and

research suggest that consciousness and unconsciousness are more complicated than falling off a ladder. That is, consciousness is more than just being “on” or “off.” For instance, Sigmund Freud (1856 – 1939)—a psychological theorist—understood that even while we are awake, many things lay outside the realm of our conscious awareness (like being in the car and forgetting the rest of the world can see into your windows). In response to this notion, Freud

introduced the concept of the “subconscious” (**Freud, 2001**) and proposed that some of our memories and even our basic motivations are not always accessible to our conscious minds.

Upon reflection, it is easy to see how slippery a topic consciousness is. For example, are people conscious when they are daydreaming? What about when they are drunk? In this module, we will describe several levels of consciousness and then discuss altered states of consciousness such as hypnosis and sleep.

Levels of Awareness

In 1957, a marketing researcher inserted the words “Eat Popcorn” onto one frame of a film being shown all across the United States. And although that frame was only projected onto the movie screen for 1/24th of a second—a speed too fast to be perceived by conscious awareness—the researcher reported an increase in popcorn sales by nearly 60%. Almost immediately, all forms of “subliminal messaging” were regulated in the US and banned in countries such as Australia and the United Kingdom. Even though it was later shown that the researcher had made up the data (he hadn’t even inserted the words into the film), this fear about influences on our subconscious persists. At its heart, this issue pits various levels of awareness against one another. On the one hand, we have the “low awareness” of subtle, even subliminal influences. On the other hand, there is you—the conscious thinking, feeling you which includes all that you are currently aware of, even reading this sentence. However, when we consider these different levels of awareness separately, we can better understand how they operate.

Low Awareness

You are constantly receiving and evaluating sensory information. Although each moment has too many sights, smells, and sounds for them all to be consciously considered, our brains are nonetheless processing all that information. For example, have you ever been at a party, overwhelmed by all the people and conversation, when out of nowhere you hear your name called? Even though you have no idea what else the person is saying, you are somehow conscious of your name (for more on this, “the cocktail party effect,” see the chapter on Attention). So, even though you may not be *aware* of various stimuli in your environment, your brain is paying closer attention than you think.

Similar to a reflex (like jumping when startled), some **cues**, or significant sensory information, will automatically elicit a response from us even though we never consciously perceive it. For example, Öhman and Soares (1994) measured subtle variations in sweating of participants with a fear of snakes. The researchers flashed pictures of different objects (e.g., mushrooms, flowers, and most importantly, snakes) on a screen in front of them, but did so at speeds that left the participant clueless as to what he or she had actually seen. However, when snake pictures were flashed, these participants started sweating more (i.e., a sign of fear), even though they had no idea what they’d just viewed!

Although our brains perceive some stimuli without our conscious awareness, do they really affect our subsequent thoughts and behaviors? In a landmark study, **Bargh, Chen, and Burrows (1996)** had participants solve a word search puzzle where the answers pertained to words about the elderly (e.g., “old,” “grandma”) or something random (e.g., “notebook,” “tomato”). Afterward, the researchers secretly measured how fast the participants walked down the hallway exiting the experiment. And although none of the participants were aware

of a theme to the answers, those who had solved a puzzle with elderly words (vs. those with other types of words) walked more slowly down the hallway!

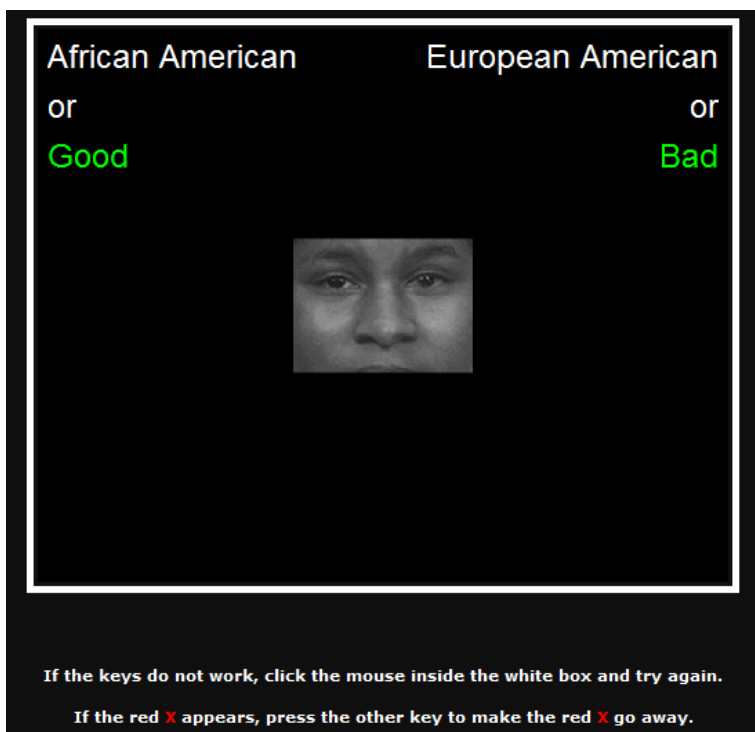
Priming Studies and Replication

If the results of priming studies sound too fantastic to be believed, you are not alone in your skepticism. Recently, many studies in psychology – including many priming studies – have come under scrutiny because they do not “replicate”. This means that when later researchers have attempted to recreate certain studies, they have not always gotten the same – or even similar – results. Non-replication does not suggest that the original researchers “faked” the results, but that there may have been flaws in the original sampling or research methods. Fortunately, researchers are very aware of the problem of non-replication and have taken steps to address the issue.

This effect is called **priming** (i.e., readily “activating” certain concepts and associations from one’s memory) has been found in a number of other studies. For example, priming people by having them drink from a warm glass (vs. a cold one) resulted in behaving more “warmly” toward others (**Williams & Bargh, 2008**). Although all of these influences occur beneath one’s conscious awareness, they still have a significant effect on one’s subsequent thoughts and behaviors.

In the last two decades, researchers have made advances in studying aspects of psychology that exist beyond conscious

awareness. As you can understand, it is difficult to use self-reports and surveys to ask people about motives or beliefs that they, themselves, might not even be aware of! One way of side-stepping this difficulty can be found in the **implicit associations test**, or IAT (**Greenwald, McGhee & Schwartz, 1998**). This research method uses computers to assess people's reaction times to various stimuli and is a very difficult test to fake because it records automatic reactions that occur in milliseconds. For instance, to shed light on deeply held biases, the IAT might present photographs of Caucasian faces and Asian faces while asking research participants to click buttons indicating either "good" or "bad" as quickly as possible. Even if the participant clicks "good" for every face shown, the IAT can still pick up tiny delays in responding. Delays are associated with more mental effort needed to process information. When information is processed quickly—as in the example of white faces being judged as "good"—it can be contrasted with slower processing—as in the example of Asian faces being judged as "good"—and the difference in processing speed is reflective of bias. In this regard, the IAT has been used for investigating stereotypes (**Nosek, Banaji & Greenwald, 2002**) as well as self-esteem (**Greenwald & Farnam, 2000**). This method can help uncover non-conscious biases as well as those that we are motivated to suppress.



An actual screenshot from an IAT (Implicit Association Test) that a person might take to test their own mental representations of various cognitive constructs. In this particular case, this is an item testing an individual's unconscious reaction towards members of various ethnic groups. [Image: Courtesy of Anthony Greenwald from Project Implicit]

High Awareness

Just because we may be influenced by these “invisible” factors, it doesn’t mean we are helplessly controlled by them. The other side of the awareness continuum is known as “high awareness.” This includes effortful attention and careful decision making. For example, when you listen to a funny story on a date, or consider which class schedule would be preferable, or

complete a complex math problem, you are engaging a state of consciousness that allows you to be highly aware of and focused on particular details in your environment.

Mindfulness is a state of higher consciousness that includes an awareness of the thoughts passing through one's head. For example, have you ever snapped at someone in frustration, only to take a moment and reflect on why you responded so aggressively? This more effortful consideration of your thoughts could be described as an expansion of your conscious awareness as you take the time to consider the possible influences on your thoughts. Research has shown that when you engage in this more



Meditation has been practiced for centuries in religious contexts. In the past 50 years it has become increasingly popular as a secular practice. Scientific studies have linked meditation to lower stress and higher well-being. [Image: Indrek Torilo, <https://goo.gl/Bc5lwm>, CC BY-NC 2.0, <https://goo.gl/Fllc2e>]

deliberate consideration, you are less persuaded by irrelevant yet biasing influences, like the presence of a celebrity in an advertisement (**Petty & Cacioppo, 1986**). Higher awareness is also associated with recognizing when you're using a stereotype, rather than fairly evaluating another person (**Gilbert & Hixon, 1991**).

Humans alternate between low and high thinking states. That is, we shift between focused attention and a less attentive default state, and we have neural networks for both (**Raichle, 2015**). Interestingly, the the less we're paying attention, the more likely we are to be influenced by non-conscious stimuli (**Chaiken, 1980**). Although these subtle influences may affect us, we can use our higher conscious awareness to protect

against external influences. In what's known as the **Flexible Correction Model (Wegener & Petty, 1997)**, people who are aware that their thoughts or behavior are being influenced by an undue, outside source, can correct their attitude against the bias. For example, you might be aware that you are influenced by mention of specific political parties. If you were motivated to consider a government policy you can take your own biases into account to attempt to consider the policy in a fair way (on its own merits rather than being attached to a certain party).

To help make the relationship between lower and higher consciousness clearer, imagine the brain is like a journey down a river. In low awareness, you simply float on a small rubber raft and let the currents push you. It's not very difficult to just drift along but you also don't have total control. Higher states of consciousness are more like traveling in a canoe. In this scenario, you have a paddle and can steer, but it requires more effort. This analogy applies to many states of consciousness, but not all. What about other states such as like sleeping, daydreaming, or hypnosis? How are these related to our conscious awareness?

	Costs	Benefits
Low Awareness	<i>Influenced by subtle factors</i>	<i>Saves mental effort</i>
High Awareness	<i>Uses mental effort</i>	<i>Can overcome some biases</i>

Table 1: States of Consciousness

Other States of Consciousness

Hypnosis

If you've ever watched a stage hypnotist perform, it may paint a misleading portrait of this state of consciousness. The hypnotized people on stage, for example, appear to be in a state similar to sleep. However, as the hypnotist continues with the show, you would recognize some profound differences between sleep and hypnosis. Namely, when you're asleep, hearing the word "strawberry" doesn't make you flap your arms like a chicken. In stage performances, the hypnotized participants appear to be highly suggestible, to the point that they are seemingly under the hypnotist's control. Such performances are entertaining but have a way of sensationalizing the true nature of hypnotic states.



People being hypnotized on stage.
[Image: New Media Expo,
<https://goo.gl/FWgBqs>, CC
BY-NC-SA 2.0, <https://goo.gl/Fllc2e>]

Hypnosis is an actual, documented phenomenon—one that has been studied and debated for over 200 years (**Pekala et al., 2010**). Franz Mesmer (1734 – 1815) is often credited as among the first people to “discover” hypnosis, which he used to treat members of elite society who were experiencing psychological distress. It is from Mesmer’s name that we get the English word, “mesmerize” meaning

“to entrance or transfix a person’s attention.” Mesmer attributed the effect of hypnosis to “animal magnetism,” a

supposed universal force (similar to gravity) that operates through all human bodies. Even at the time, such an account of hypnosis was not scientifically supported, and Mesmer himself was frequently the center of controversy.

Over the years, researchers have proposed that **hypnosis** is a mental state characterized by reduced peripheral awareness and increased focus on a singular stimulus, which results in an enhanced susceptibility to suggestion (**Kihlstrom, 2003**). For example, the hypnotist will usually induce hypnosis by getting the person to pay attention only to the hypnotist's voice. As the individual focuses more and more on that, s/he begins to forget the context of the setting and responds to the hypnotist's suggestions as if they were his or her own. Some people are naturally more suggestible, and therefore more "hypnotizable" than are others, and this is especially true for those who score high in empathy (**Wickramasekera II & Szlyk, 2003**). One common "trick" of stage hypnotists is to discard volunteers who are less suggestible than others.

Dissociation is the separation of one's awareness from everything besides what one is centrally focused on. For example, if you've ever been daydreaming in class, you were likely so caught up in the fantasy that you didn't hear a word the teacher said. During hypnosis, this dissociation becomes even more extreme. That is, a person concentrates so much on the words of the hypnotist that s/he loses perspective of the rest of the world around them. As a consequence of dissociation, a person is less effortful, and less self-conscious in consideration of his or her own thoughts and behaviors. Similar to low awareness states, where one often acts on the first thought that comes to mind, so, too, in hypnosis does the individual simply follow the first thought that comes to mind, i.e., the hypnotist's suggestion. Still, just because one is more susceptible to suggestion under hypnosis, it doesn't mean s/he will do anything that's ordered. To be hypnotized, you must first *want* to be hypnotized (i.e., you can't be hypnotized

against your will; **Lynn & Kirsh, 2006**), and once you are hypnotized, you won't do anything you wouldn't also do while in a more natural state of consciousness (**Lynn, Rhue, & Weekes, 1990**).

Today, **hypnotherapy** is still used in a variety of formats, and it has evolved from Mesmer's early tinkering with the concept. Modern hypnotherapy often uses a combination of relaxation, suggestion, motivation and expectancies to create a desired mental or behavioral state. Although there is mixed evidence on whether hypnotherapy can help with addiction reduction (e.g., quitting smoking; **Abbot et al., 1998**) there is some evidence that it can be successful in treating sufferers of acute and chronic pain (**Ewin, 1978; Syrjala et al., 1992**). For example, one study examined the treatment of burn patients with either hypnotherapy, pseudo-hypnosis (i.e., a placebo condition), or no treatment at all. Afterward, even though people in the placebo condition experienced a 16% decrease in pain, those in the actual hypnosis condition experienced a reduction of nearly 50% (**Patterson et al., 1996**). Thus, even though hypnosis may be sensationalized for television and movies, its ability to disassociate a person from their environment (or their pain) in conjunction with increased suggestibility to a clinician's recommendations (e.g., "you will feel less anxiety about your chronic pain") is a documented practice with actual medical benefits.

Now, similar to hypnotic states, **trance states** also involve a dissociation of the self; however, people in a trance state are said to have less voluntary control over their behaviors and actions. Trance states often occur in religious ceremonies, where the person believes he or she is "possessed" by an otherworldly being or force. While in trance, people report anecdotal accounts of a "higher consciousness" or communion with a greater power. However, the body of research investigating this phenomenon tends to reject the claim that

these experiences constitute an “altered state of consciousness.”

Most researchers today describe both hypnosis and trance states as “subjective” alterations of consciousness, not an actually distinct or evolved form (**Kirsch & Lynn, 1995**). Just like you feel different when you’re in a state of deep relaxation, so, too, are hypnotic and trance states simply shifts from the standard conscious experience. Researchers contend that even though both hypnotic and trance states appear and feel wildly different than the normal human experience, they can be explained by standard socio-cognitive factors like imagination, expectation, and the interpretation of the situation.

Sleep

You may have experienced the sensation— as you are falling asleep— of falling and then found yourself physically jerking forward and grabbing out as if you were really falling. Sleep is a unique state of consciousness; it lacks full awareness but the brain is still active. People generally follow a “biological clock” that impacts when they naturally become drowsy, when they fall asleep, and the



Sleep is necessary in order for people to function well. [Image: jaci XIII, <https://goo.gl/pog6Fr>, CC BY-NC 2.0, <https://goo.gl/Filc2e>]

time they naturally awaken. The hormone **melatonin** increases at night and is associated with becoming sleepy. Your natural daily rhythm, or **Circadian Rhythm**, can be influenced by the amount of daylight to which you are exposed as well as your

work and activity schedule. Changing your location, such as flying from Canada to England, can disrupt your natural sleep rhythms, and we call this **jet lag**. You can overcome jet lag by synchronizing yourself to the local schedule by exposing yourself to daylight and forcing yourself to stay awake even though you are naturally sleepy.

Interestingly, sleep itself is more than shutting off for the night (or for a nap). Instead of turning off like a light with a flick of a switch, your shift in consciousness is reflected in your brain's electrical activity. While you are awake and alert your brain activity is marked by *betawaves*. Beta waves are characterized by being high in frequency but low in intensity. In addition, they are the most inconsistent brain wave and this reflects the wide variation in sensory input that a person processes during the day. As you begin to relax these change to *alpha* waves. These waves reflect brain activity that is less frequent, more consistent and more intense. As you slip into actual sleep you transition through many stages. Scholars differ on how they characterize sleep stages with some experts arguing that there are four distinct stages (**Manoach et al., 2010**), while others recognize five (**Šušmáková, & Krakovská, 2008**) but they all distinguish between those that include rapid eye movement (REM) and those that are non-rapid eye movement (NREM). In addition, each stage is typically characterized by its own unique pattern of brain activity:

- Stage 1 (called NREM 1, or N1) is the “falling asleep” stage and is marked by theta waves.
- Stage 2 (called NREM 2, or N2) is considered a light sleep. Here, there are occasional “sleep spindles,” or very high intensity brain waves. These are thought to be associated with the processing of memories. NREM 2 makes up about 55% of all sleep.
- Stage 3 (called NREM 3, or N3) makes up between 20-25% of all sleep and is marked by greater muscle relaxation and

the appearance of delta waves.

- Finally, REM sleep is marked by rapid eye movement (REM). Interestingly, this stage—in terms of brain activity—is similar to wakefulness. That is, the brain waves occur less intensely than in other stages of sleep. REM sleep accounts for about 20% of all sleep and is associated with dreaming.

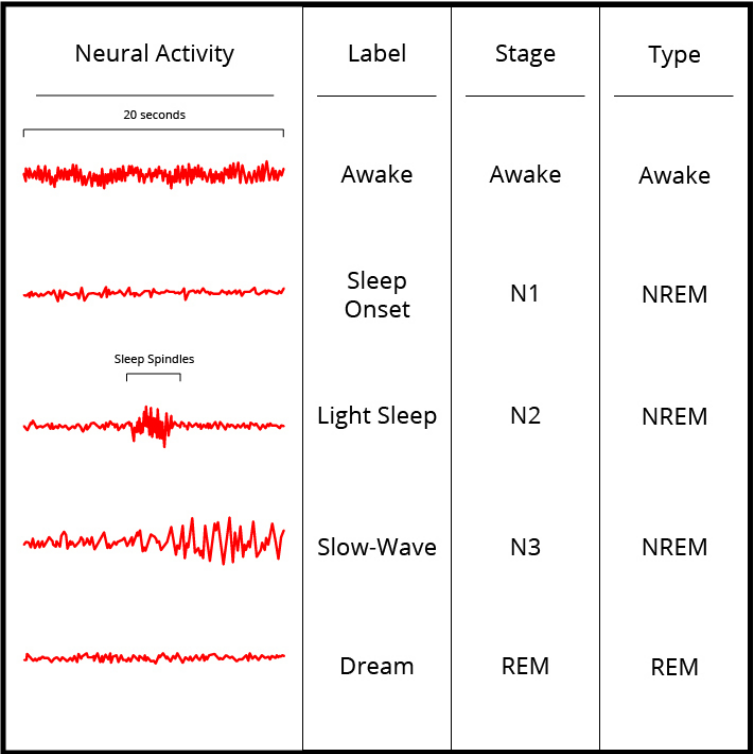


Figure 1. Changes in brain activity or brainwaves across different stages of consciousness – from being awake and throughout various stages of sleep.

Dreams are, arguably, the most interesting aspect of sleep. Throughout history dreams have been given special

importance because of their unique, almost mystical nature. They have been thought to be predictions of the future, hints of hidden aspects of the self, important lessons about how to live life, or opportunities to engage in impossible deeds like flying. There are several competing theories of why humans dream. One is that it is our nonconscious attempt to make sense of our daily experiences and learning. Another, popularized by Freud, is that dreams represent taboo or troublesome wishes or desires. Regardless of the specific reason we know a few facts about dreams: all humans dream, we dream at every stage of sleep, but dreams during REM sleep are especially vivid. One under-explored area of dream research is the possible social functions of dreams: we often share our dreams with others and use them for entertainment value.

Sleep serves many functions, one of which is to give us a period of mental and physical restoration. Children generally need more sleep than adults since they are developing. It is so vital, in fact, that a lack of sleep is associated with a wide range of problems. People who do not receive adequate sleep are more irritable, have slower reaction time, have more difficulty sustaining attention, and make poorer decisions. Interestingly, this is an issue relevant to the lives of college students. In one highly cited study researchers found that 1 in 5 students took more than 30 minutes to fall asleep at night, 1 in 10 occasionally took sleep medications, and more than half reported being “mostly tired” in the mornings (Buboltz, et al, 2001).

Psychoactive Drugs

On April 16, 1943, Albert Hoffman—a Swiss chemist working in a pharmaceutical company—accidentally ingested a newly synthesized drug. The drug—lysergic acid diethylimide (LSD)—turned out to be a powerful hallucinogen. Hoffman went home and later reported the effects of the drug,

describing them as seeing the world through a “warped mirror” and experiencing visions of “extraordinary shapes with intense, kaleidoscopic play of colors.” Hoffman had discovered what members of many traditional cultures around the world already knew: there are substances that, when ingested, can have a powerful effect on perception and on consciousness.

Drugs operate on human physiology in a variety of ways and researchers and medical doctors tend to classify drugs according to their effects. Here we will briefly cover 3 categories of drugs: hallucinogens, depressants, and stimulants.

Hallucinogens

It is possible that hallucinogens are the substance that have, historically, been used the most widely. Traditional societies have used plant-based hallucinogens such as peyote, ebene, and psilocybin mushrooms in a wide range of religious ceremonies. **Hallucinogens** are substances that alter a person's perceptions, often by creating visions or hallucinations that are not real. There are a wide range of hallucinogens and many are used as recreational substances in industrialized societies. Common examples include marijuana, LSD, and MDMA (also known as “ecstasy”). Marijuana is the dried flowers of the hemp plant and is often smoked to produce **euphoria**. The active ingredient in marijuana is called THC and can produce distortions in the perception of time, can create a sense of rambling, unrelated thoughts, and is sometimes associated with increased hunger or excessive laughter. The use and possession of marijuana is illegal in most places but this appears to be a trend that is changing. Uruguay, Bangladesh, and several of the United States, have recently legalized marijuana. This may be due, in part, to changing public attitudes or to the fact that marijuana is increasingly

used for medical purposes such as the management of nausea or treating glaucoma.

Depressants

Depressants are substances that, as their name suggests, slow down the body's physiology and mental processes. Alcohol is the most widely used depressant. Alcohol's effects include the reduction of inhibition, meaning that intoxicated people are more likely to act in ways they would otherwise be reluctant to. Alcohol's psychological effects are the result of it increasing the neurotransmitter GABA. There are also physical effects, such as loss of balance and coordination, and these stem from the way that alcohol interferes with the coordination of the visual and motor systems of the brain. Despite the fact that alcohol is so widely accepted in many cultures it is also associated with a variety of dangers. First, alcohol is toxic, meaning that it acts like a poison because it is possible to drink more alcohol than the body can effectively remove from the bloodstream. When a person's **blood alcohol content (BAC)** reaches .3 to .4% there is a serious risk of death. Second, the lack of judgment and physical control associated with alcohol is associated with more risk taking behavior or dangerous behavior such as drunk driving. Finally, alcohol is addictive and heavy drinkers often experience significant interference with their ability to work effectively or in their close relationships.

Other common depressants include opiates (also called "narcotics"), which are substances synthesized from the poppy flower. Opiates stimulate endorphin production in the brain and because of this they are often used as pain killers by medical professionals. Unfortunately, because opiates such as Oxycontin so reliably produce euphoria they are increasingly used—illegally—as recreational substances. Opiates are highly addictive.

Stimulants

Stimulants are substances that “speed up” the body’s physiological and mental processes. Two commonly used stimulants are caffeine—the drug found in coffee and tea—and nicotine, the active drug in cigarettes and other tobacco products. These substances are both legal and relatively inexpensive, leading to their widespread use. Many people are attracted to stimulants because they feel more alert when under the influence of these drugs. As with any drug



Caffeine is the most widely consumed stimulant in the world. Be honest, how many cups of coffee, tea, or energy drinks have you had today? [Image: Personeelsnet, <https://goo.gl/h0GQ3R>, CC BY-SA 2.0, <https://goo.gl/iZIxAE>]

there are health risks associated with consumption. For example, excessive consumption of these types of stimulants can result in anxiety, headaches, and insomnia. Similarly, smoking cigarettes—the most common means of ingesting nicotine—is associated with higher risks of cancer. For instance, among heavy smokers 90% of lung cancer is directly attributable to smoking (**Stewart & Kleihues, 2003**).

There are other stimulants such as cocaine and methamphetamine (also known as “crystal meth” or “ice”) that are illegal substances that are commonly used. These substances act by blocking “re-uptake” of dopamine in the brain. This means that the brain does not naturally clear out the dopamine and that it builds up in the synapse, creating euphoria and alertness. As the effects wear off it stimulates strong cravings for more of the drug. Because of this these powerful stimulants are highly addictive.

Conclusion

When you think about your daily life it is easy to get lulled into the belief that there is one “setting” for your conscious thought. That is, you likely believe that you hold the same opinions, values, and memories across the day and throughout the week. But “you” are like a dimmer switch on a light that can be turned from full darkness increasingly on up to full brightness. This switch is consciousness. At your brightest setting you are fully alert and aware; at dimmer settings you are day dreaming; and sleep or being knocked unconscious represent dimmer settings still. The degree to which you are in high, medium, or low states of conscious awareness affect how susceptible you are to persuasion, how clear your judgment is, and how much detail you can recall. Understanding levels of awareness, then, is at the heart of understanding how we learn, decide, remember and many other vital psychological processes.

Check Your Knowledge

To help you with your studying, we’ve included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.





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Vocabulary

Blood Alcohol Content (BAC)

Blood Alcohol Content (BAC): a measure of the percentage of alcohol found in a person's blood. This measure is typically the standard used to determine the extent to which a person is intoxicated, as in the case of being too impaired to drive a vehicle.

Circadian Rhythm

Circadian Rhythm: The physiological sleep-wake cycle. It is influenced by exposure to sunlight as well as daily schedule and activity. Biologically, it includes changes in body temperature, blood pressure and blood sugar.

Consciousness

Consciousness: the awareness or deliberate perception of a stimulus

Cues

Cues: a stimulus that has a particular significance to the perceiver (e.g., a sight or a sound that has special relevance to the person who saw or heard it)

Depressants

Depressants: a class of drugs that slow down the body's physiological and mental processes.

Dissociation

Dissociation: the heightened focus on one stimulus or thought such that many other things around you are ignored; a disconnect between one's awareness of their environment and the one object the person is focusing on

Euphoria

Euphoria: an intense feeling of pleasure, excitement or happiness.

Flexible Correction Model

Flexible Correction Model: the ability for people to correct or change their beliefs and evaluations if they believe these judgments have been biased (e.g., if someone realizes they only thought their day was great because it was sunny, they may revise their evaluation of the day to account for this "biasing" influence of the weather)

Hallucinogens

Hallucinogens: substances that, when ingested, alter a person's perceptions, often by creating hallucinations that are not real or distorting their perceptions of time.

Hypnosis

Hypnosis: the state of consciousness whereby a person is highly responsive to the suggestions of another; this state usually involves a dissociation with one's environment and an intense focus on a single stimulus, which is usually

accompanied by a sense of relaxation

Hypnotherapy

Hypnotherapy: The use of hypnotic techniques such as relaxation and suggestion to help engineer desirable change such as lower pain or quitting smoking.

Implicit Associations Test

Implicit Associations Test (IAT): A computer reaction time test that measures a person's automatic associations with concepts. For instance, the IAT could be used to measure how quickly a person makes positive or negative evaluations of members of various ethnic groups.

Jet Lag

Jet Lag: The state of being fatigued and/or having difficulty adjusting to a new time zone after traveling a long distance (across multiple time zones).

Melatonin

Melatonin: A hormone associated with increased drowsiness and sleep.

Mindfulness

Mindfulness: a state of heightened focus on the thoughts passing through one's head, as well as a more controlled evaluation of those thoughts (e.g., do you reject or support the thoughts you're having?)

Priming

Priming: the activation of certain thoughts or feelings that make them easier to think of and act upon

Stimulants

Stimulants: a class of drugs that speed up the body's physiological and mental processes.

Trance States

Trance: a state of consciousness characterized by the experience of “out-of-body possession,” or an acute dissociation between one’s self and the current, physical environment surrounding them.

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PSYC 100 X

ATTENTION AND MEMORY

27. Attention

Original chapter by Frances Friedrich
adapted by the Queen's University
Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

We use the term “attention” all the time, but what processes or abilities does that concept really refer to? This module will focus on how attention allows us to select certain parts of our environment and ignore other parts, and what happens to the ignored information. A key concept is the idea that we are limited in how much we can do at any one time. So we will also consider what happens when someone tries to do several things at once, such as driving while using electronic devices.

Learning Objectives

- Understand why selective attention is important and how it can be studied.
- Learn about different models of when and how selection can occur.
- Understand how divided attention or multitasking is studied, and implications of multitasking in situations such as distracted driving.

What is Attention?

Before we begin exploring attention in its various forms, take a moment to consider how you think about the concept. How would you define attention, or how do you use the term? We certainly use the word very frequently in our everyday language: “ATTENTION! USE ONLY AS DIRECTED!” warns the label on the medicine bottle, meaning be alert to possible danger. “Pay attention!” pleads the weary seventh-grade teacher, not warning about danger (with possible exceptions, depending on the teacher) but urging the students to focus on the task at hand. We may refer to a child who is easily distracted as having an attention disorder, although we also are told that Americans have an attention span of about 8 seconds, down from 12 seconds in 2000, suggesting that we *all* have trouble sustaining concentration for any amount of time (from www.Statisticbrain.com). How that number was determined is not clear from the Web site, nor is it clear how attention span in the goldfish—9 seconds!—was measured, but the fact that our average span reportedly is less than that of a goldfish is intriguing, to say the least.

William James wrote extensively about attention in the late 1800s. An often quoted passage (**James, 1890/1983**) beautifully captures how intuitively obvious the concept of attention is, while it remains very difficult to define in measurable, concrete terms:

Everyone knows what attention is. It is the taking possession by the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought. Focalization, concentration of consciousness are of its essence. It implies withdrawal from some things in order to deal effectively with others. (pp. 381–382)



Notice that this description touches on the conscious nature of attention, as well as the notion that what is in consciousness is often controlled voluntarily but can also be determined by events that capture our attention. Implied in this description is the idea that we seem to have a **limited capacity** for

information processing, and that we can only attend to or be consciously aware of a small amount of information at any given time.

Many aspects of attention have been studied in the field of psychology. In some respects, we define different types of attention by the nature of the task used to study it. For example, a crucial issue in World War II was how long an individual could remain highly alert and accurate while watching a radar screen for enemy planes, and this problem led psychologists to study how attention works under such conditions. When watching for a rare event, it is easy to allow concentration to lag. (This continues to be a challenge today for TSA agents, charged with looking at images of the contents of your carry-on items in search of knives, guns, or shampoo bottles larger than 3 oz.) Attention in the context of this type of search task refers to the level of *sustained attention* or *vigilance* one can maintain. In contrast, **divided attention** tasks allow us to determine how well individuals can attend to many sources of information at once. *Spatial attention* refers specifically to how we focus on one part of our environment and how we move attention to other locations in the environment. These are all examples of different aspects of attention, but an implied element of most of these ideas is the concept of **selective attention**; some information is attended

to while other information is intentionally blocked out. This module will focus on important issues in selective and divided attention, addressing these questions:

- Can we pay attention to several sources of information at once, or do we have a limited capacity for information?
- How do we select what to pay attention to?
- What happens to information that we try to ignore?
- Can we learn to divide attention between multiple tasks?

Selective Attention

The Cocktail Party

Selective attention is *the ability to select certain stimuli in the environment to process, while ignoring distracting information*. One way to get an intuitive sense of how attention works is to consider situations in which attention is used. A party provides an excellent example for our purposes. Many people may be milling around, there is a dazzling variety of colors and sounds and smells, the buzz of many conversations is striking.



Beyond just hearing your name from the clamor at a party, other words or concepts, particularly unusual or significant ones to you, can also snag your attention.

[Image: Ross, <https://goo.gl/TVDfTn>, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

There are so many conversations going on; how is it possible to select just one and follow it? You don't have to be looking at the person talking; you may be listening with great interest to

some gossip while pretending not to hear. However, once you are engaged in conversation with someone, you quickly become aware that you cannot also listen to other conversations at the same time. You also are probably *not* aware of how tight your shoes feel or of the smell of a nearby flower arrangement. On the other hand, if someone behind you mentions your name, you typically notice it immediately and may start attending to that (much more interesting) conversation. This situation highlights an interesting set of observations. We have an amazing ability to select and track one voice, visual object, etc., even when a million things are competing for our attention, but at the same time, we seem to be limited in how much we can attend to at one time, which in turn suggests that attention is crucial in selecting what is important. How does it all work?

Dichotic Listening Studies

This cocktail party scenario is the quintessential example of selective attention, and it is essentially what some early researchers tried to replicate under controlled laboratory conditions as a starting point for understanding the role of attention in perception (e.g., **Cherry, 1953**; **Moray, 1959**). In particular, they used **dichotic listening** and **shadowing** tasks to evaluate the selection process. Dichotic listening simply refers to the situation when two messages are presented simultaneously to an individual, with one message in each ear. In order to control which message the person attends to, the individual is asked to repeat back or “shadow” one of the messages as he hears it. For example, let’s say that a story about a camping trip is presented to John’s left ear, and a story about Abe Lincoln is presented to his right ear. The typical dichotic listening task would have John repeat the story

presented to one ear as he hears it. Can he do that without being distracted by the information in the other ear?

People can become pretty good at the shadowing task, and they can easily report the content of the message that they attend to. But what happens to the ignored message? Typically, people can tell you if the ignored message was a man's or a woman's voice, or other physical characteristics of the speech, but they cannot tell you what the message was about. In fact, many studies have shown that people in a shadowing task were not aware of a change in the language of the message (e.g., from English to German; **Cherry, 1953**), and they didn't even notice when the same word was repeated in the unattended ear more than 35 times (**Moray, 1959**)! Only the basic physical characteristics, such as the pitch of the unattended message, could be reported.

On the basis of these types of experiments, it seems that we can answer the first question about how much information we can attend to very easily: not very much. We clearly have a limited capacity for processing information for meaning, making the selection process all the more important. The question becomes: How does this selection process work?

Models of Selective Attention

Broadbent's Filter Model. Many researchers have investigated how selection occurs and what happens to ignored information. Donald Broadbent was one of the first to try to characterize the selection process. His Filter Model was based on the dichotic listening tasks described above as well as other types of experiments (**Broadbent, 1958**). He found that people select information on the basis of *physical features*: the sensory channel (or ear) that a message was coming in, the pitch of the voice, the color or font of a visual message. People seemed vaguely aware of the physical features of the

unattended information, but had no knowledge of the meaning. As a result, Broadbent argued that selection occurs *very early*, with no additional processing for the unselected information. A flowchart of the model might look like this:

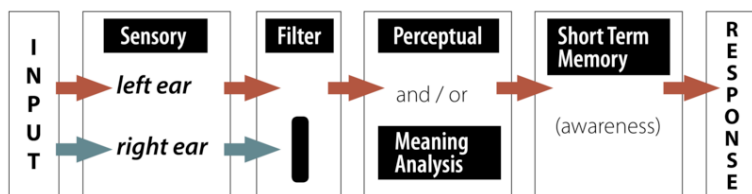


Figure 1: This figure shows information going in both the left and right ears. Some basic sensory information, such as pitch, is processed, but the filter only allows the information from one ear to be processed further. Only the information from the left ear is transferred to short-term memory (STM) and conscious awareness, and then further processed for meaning. That means that the ignored information never makes it beyond a basic physical analysis.

Treisman's Attenuation Model

Broadbent's model makes sense, but if you think about it you already know that it cannot account for all aspects of the Cocktail Party Effect. What doesn't fit? The fact is that you tend to hear your own name when it is spoken by someone, even if you are deeply engaged in a conversation. We mentioned earlier that people in a shadowing experiment were unaware of a word in the unattended ear that was repeated many times—and yet many people noticed their own name in the unattended ear even it occurred only once.

Anne Treisman (1960) carried out a number of dichotic listening experiments in which she presented two different stories to the two ears. As usual, she asked people to shadow the message in one ear. As the stories progressed,

however, she switched the stories to the opposite ears. Treisman found that individuals spontaneously followed the story, or the content of the message, when it shifted from the left ear to the right ear. Then they realized they were shadowing the wrong ear and switched back.

Results like this, and the fact that you tend to hear meaningful information even when you aren't paying attention to it, suggest that we *do* monitor the unattended information to some degree on the basis of its meaning. Therefore, the filter theory can't be right to suggest that unattended information is completely blocked at the sensory analysis level. Instead, Treisman suggested that selection *starts* at the physical or perceptual level, but that the unattended information is not blocked completely, it is just weakened or *attenuated*. As a result, highly meaningful or pertinent information in the unattended ear will get through the filter for further processing at the level of meaning. The figure below shows information going in both ears, and in this case there is no filter that completely blocks nonselected information. Instead, selection of the left ear information strengthens that material, while the nonselected information in the right ear is weakened. However, if the preliminary analysis shows that the nonselected information is especially pertinent or meaningful (such as your own name), then the Attenuation Control will instead strengthen the more meaningful information.

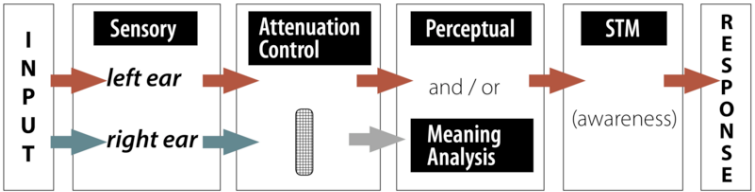


Figure 2

Late Selection Models

Other selective attention models have been proposed as well. A *late selection* or *response selection* model proposed by Deutsch and Deutsch (1963) suggests that all information in the unattended ear is processed on the basis of meaning, not just the selected or highly pertinent information. However, only the information that is relevant for the task response gets into conscious awareness. This model is consistent with ideas of subliminal perception; in other words, that you don't have to be aware of or attending a message for it to be fully processed for meaning.

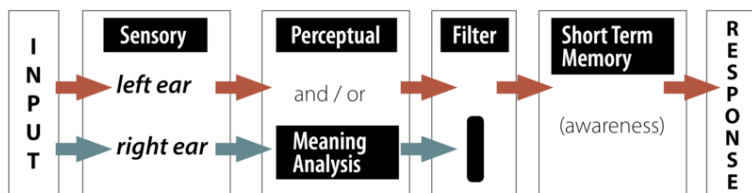


Figure 3

You might notice that this figure looks a lot like that of the Early Selection model—only the location of the selective filter has changed, with the assumption that analysis of meaning occurs *before* selection occurs, but only the selected information becomes conscious.

Multimode Model

Why did researchers keep coming up with different models? Because no model really seemed to account for all the data, some of which indicates that nonselected information is

blocked completely, whereas other studies suggest that it can be processed for meaning. The multimode model addresses this apparent inconsistency, suggesting that the stage at which selection occurs can change depending on the task. Johnston and Heinz (1978) demonstrated that under some conditions, we can select what to attend to at a very early stage and we do not process the content of the unattended message very much at all. Analyzing physical information, such as attending to information based on whether it is a male or female voice, is relatively easy; it occurs automatically, rapidly, and doesn't take much effort. Under the right conditions, we can select what to attend to on the basis of the meaning of the messages. However, the late selection option—processing the content of all messages before selection—is more difficult and requires more effort. The benefit, though, is that we have the flexibility to change how we deploy our attention depending upon what we are trying to accomplish, which is one of the greatest strengths of our cognitive system.

This discussion of selective attention has focused on experiments using auditory material, but the same principles hold for other perceptual systems as well. Neisser (1979) investigated some of the same questions with visual materials by superimposing two semi-transparent video clips and asking viewers to attend to just one series of actions. As with the auditory materials, viewers often were unaware of what went on in the other clearly visible video. Twenty years later, Simons and Chabris (1999) explored and expanded these findings using similar techniques, and triggered a flood of new work in an area referred to as inattention blindness. We touch on those ideas below, and you can also refer to another Module, Failures of Awareness: The Case of Inattention Blindness for a more complete discussion.

Focus Topic 1: Subliminal Perception

The idea of subliminal perception—that stimuli presented

below the threshold for awareness can influence thoughts, feelings, or actions—is a fascinating and kind of creepy one. Can messages you are unaware of, embedded in movies or ads or the music playing in the grocery store, really influence what you buy? Many such claims of the power of subliminal perception have been made. One of the most famous came from a market researcher who claimed that the message “Eat Popcorn” briefly flashed throughout a movie increased popcorn sales by more than 50%, although he later admitted that the study was made up (**Merikle, 2000**). Psychologists have worked hard to investigate whether this is a valid phenomenon. Studying subliminal perception is more difficult than it might seem, because of the difficulty of establishing what the threshold for consciousness is or of even determining what type of threshold is important; for example, Cheesman and Merikle (**1984, 1986**) make an important distinction between objective and subjective thresholds. The bottom line is that there is some evidence that individuals can be influenced by stimuli they are not aware of, but how complex the stimuli can be or the extent to which unconscious material can affect behavior is not settled (e.g., **Bargh & Morsella, 2008; Greenwald, 1992; Merikle, 2000**).

Divided Attention and Multitasking

In spite of the evidence of our limited capacity, we all like to think that we can do several things at once. Some people claim to be able to multitask without any problem: reading a textbook while watching television and talking with friends; talking on the phone while playing computer games; texting while driving. The fact is that we sometimes can *seem* to juggle several things at once, but the question remains whether dividing attention in this way impairs performance.

Is it possible to overcome the limited capacity that we

experience when engaging in cognitive tasks? We know that with extensive practice, we can acquire skills that do not appear to require conscious attention. As we walk down the street, we don't need to think consciously about what muscle to contract in order to take the next step. Indeed, paying attention to automated skills can lead to a breakdown in performance, or "choking" (e.g., **Beilock & Carr, 2001**). But what about higher level, more mentally demanding tasks: Is it possible to learn to perform two complex tasks at the same time?

Divided Attention Tasks



Unless a task is fully automated, some researchers suggest that “multi-tasking” doesn’t really exist; you are just rapidly switching your attention back and forth between tasks. [Image: CC0 Public Domain, <https://goo.gl/m25gce>]

In a classic study that examined this type of divided attention task, two participants were trained to take dictation for spoken words while reading unrelated material for comprehension (**Spelke, Hirst, & Neisser, 1976**). In divided attention tasks such as these, each task is evaluated separately, in order to determine baseline performance when the individual can allocate as many cognitive resources as

necessary to one task at a time. Then performance is evaluated when the two tasks are performed simultaneously. A decrease in performance for either task would suggest that even if attention can be divided or switched between the tasks, the cognitive demands are too great to avoid disruption of

performance. (We should note here that divided attention tasks are designed, in principle, to see if two tasks can be carried out simultaneously. A related research area looks at *task switching* and how well we can switch back and forth among different tasks [e.g., **Monsell, 2003**]. It turns out that switching itself is cognitively demanding and can impair performance).

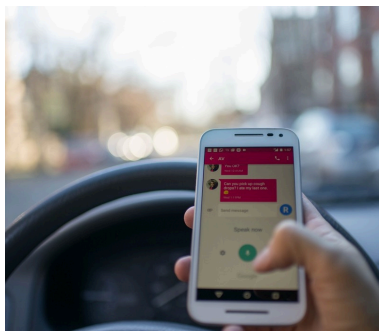
The focus of the Spelke et al. (**1976**) study was whether individuals could learn to perform two relatively complex tasks concurrently, without impairing performance. The participants received plenty of practice—the study lasted 17 weeks and they had a 1-hour session each day, 5 days a week. These participants were able to learn to take dictation for lists of words and read for comprehension without affecting performance in either task, and the authors suggested that perhaps there are not fixed limits on our attentional capacity. However, changing the tasks somewhat, such as reading aloud rather than silently, impaired performance initially, so this multitasking ability may be specific to these well-learned tasks. Indeed, not everyone could learn to perform two complex tasks without performance costs (**Hirst, Neisser, & Spelke, 1978**), although the fact that some can is impressive.

Distracted Driving

More relevant to our current lifestyles are questions about multitasking while texting or having cell phone conversations. Research designed to investigate, under controlled conditions, multitasking while driving has revealed some surprising results. Certainly there are many possible types of distractions that could impair driving performance, such as applying makeup using the rearview mirror, attempting (usually in vain) to stop the kids in the backseat from fighting, fiddling with the CD player, trying to negotiate a handheld cell phone, a

cigarette, and a soda all at once, eating a bowl of cereal while driving (!). But we tend to have a strong sense that we CAN multitask while driving, and cars are being built with more and more technological capabilities that encourage multitasking. How good are we at dividing attention in these cases?

Most people acknowledge the distraction caused by texting while driving and the reason seems obvious: Your eyes are off the road and your hands and at least one hand (often both) are engaged while texting. However, the problem is not simply one of occupied hands or eyes, but rather that the cognitive demands on our limited capacity systems can seriously impair driving performance (Strayer,



If you look at your phone for just 5 seconds while driving at 55mph, that means you have driven the length of a football field without looking at the road. [Image: CC0 Public Domain, <https://goo.gl/m25gce>]

Watson, & Drews, 2011). The effect of a cell phone conversation on performance (such as not noticing someone's brake lights or responding more slowly to them) is just as significant when the individual is having a conversation with a hands-free device as with a handheld phone; the same impairments do not occur when listening to the radio or a book on tape (**Strayer & Johnston, 2001**). Moreover, studies using eye-tracking devices have shown that drivers are less likely to later recognize objects that they *did* look at when using a cell phone while driving (**Strayer & Drews, 2007**). These findings demonstrate that cognitive distractions such as cell phone conversations can produce inattention blindness, or a lack of awareness of what is right before your eyes (see also, **Simons & Chabris, 1999**). Sadly, although we all like to think that we can multitask while driving, in fact the percentage of people who can truly perform

cognitive tasks without impairing their driving performance is estimated to be about 2% (**Watson & Strayer, 2010**).

Studying Attention & Cognition at Queen's

We have many courses related to attention, cognition, and cognitive neuroscience in our program. A great way to get started in learning more is to consider taking PSYC221: Cognitive Psychology.

Summary

It may be useful to think of attention as a mental resource, one that is needed to focus on and fully process important information, especially when there is a lot of distracting “noise” threatening to obscure the message. Our selective attention system allows us to find or track an object or conversation in the midst of distractions. Whether the selection process occurs early or late in the analysis of those events has been the focus of considerable research, and in fact how selection occurs may very well depend on the specific conditions. With respect to divided attention, in general we can only perform one cognitively demanding task at a time, and we may not even be aware of unattended events even though they might seem too obvious to miss (check out some examples in the Outside Resources below). This type of inattention blindness can occur even in well-learned tasks, such as driving while talking on a cell phone. Understanding how attention works is clearly important, even for our everyday lives.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Dichotic listening

An experimental task in which two messages are presented to different ears.

Divided attention

The ability to flexibly allocate attentional resources between two or more concurrent tasks.

Inattentional blindness

The failure to notice a fully visible object when attention is devoted to something else.

Limited capacity

The notion that humans have limited mental resources that can be used at a given time.

Selective attention

The ability to select certain stimuli in the environment to process, while ignoring distracting information.

Shadowing

A task in which the individual is asked to repeat an auditory message as it is presented.

Subliminal perception

The ability to process information for meaning when the

individual is not consciously aware of that information.

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28. Memories as Types and Stages

Original chapter by Charles Stangor with adaptations by Jennifer Walinga, adapted by the Queen's University Psychology Department

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

You'll notice that this chapter looks a bit different from our earlier chapters. A benefit of an Open Access textbook is that we have the ability to source and adapt content written by experts globally that address issues that are important for our course. This chapter is from the text “Introduction to Psychology–1st Canadian Edition.” You can find the book [here](#).

Learning Objectives

- Compare and contrast explicit and implicit memory, identifying the features that define each.
- Explain the function and duration of eidetic and echoic memories.
- Summarize the capacities of short-term memory and explain how working memory is used to process information in it.

As you can see in Table 9.1, “Memory Conceptualized in Terms of Types, Stages, and Processes,” psychologists conceptualize memory in terms of *types*, in terms of *stages*, and in terms of *processes*. In this section we will consider the two **types of memory**, *explicit memory* and *implicit memory*, and then the three major **memory stages**: *sensory*, *short-term*, and *long-term* (Atkinson & Shiffrin, 1968). Then, in the next section, we will consider the nature of long-term memory, with a particular emphasis on the cognitive techniques we can use to improve our memories. Our discussion will focus on the three processes that are central to **long-term memory**: *encoding*, *storage*, and *retrieval*.

Table 9.1 Memory Conceptualized in Terms of Types, Stages, and Processes.

As types	Explicit memory
	Implicit memory
	Sensory memory
As stages	Short-term memory
	Long-term memory
	Encoding
As processes	Storage
	Retrieval

Explicit Memory

When we assess memory by asking a person to consciously remember things, we are measuring *explicit memory*. **Explicit memory** refers to *knowledge or experiences that can be consciously remembered*. As you can see in Figure 9.2, “Types of Memory,” there are two types of explicit memory: *episodic* and *semantic*. **Episodic memory** refers

to the *firsthand experiences that we have had* (e.g., recollections of our high school graduation day or of the fantastic dinner we had in New York last year). **Semantic memory** refers to our *knowledge of facts and concepts about the world* (e.g., that the absolute value of -90 is greater than the absolute value of 9 and that one definition of the word “affect” is “the experience of feeling or emotion”).

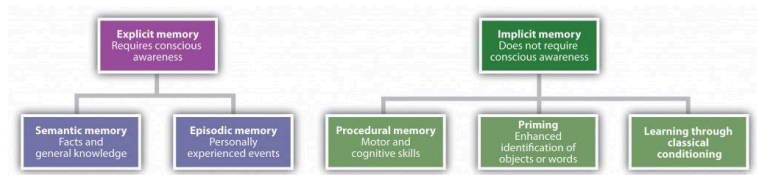


Figure 9.2 Types of Memory.

Explicit memory is assessed using measures in which the individual being tested must consciously attempt to remember the information. A **recall memory** test is *a measure of explicit memory that involves bringing from memory information that has previously been remembered*. We rely on our recall memory when we take an essay test, because the test requires us to generate previously remembered information. A multiple-choice test is an example of a **recognition memory test**, *a measure of explicit memory that involves determining whether information has been seen or learned before*.

Your own experiences taking tests will probably lead you to agree with the scientific research finding that recall is more difficult than recognition. Recall, such as required on essay tests, involves two steps: first generating an answer and then determining whether it seems to be the correct one. Recognition, as on multiple-choice test, only involves determining which item from a list seems most correct (**Haist, Shimamura, & Squire, 1992**). Although they involve different

processes, recall and recognition memory measures tend to be correlated. Students who do better on a multiple-choice exam will also, by and large, do better on an essay exam (**Bridgeman & Morgan, 1996**).

A third way of measuring memory is known as *relearning* (**Nelson, 1985**). Measures of **relearning** (or savings) *assess how much more quickly information is processed or learned when it is studied again after it has already been learned but then forgotten*. If you have taken some French courses in the past, for instance, you might have forgotten most of the vocabulary you learned. But if you were to work on your French again, you'd learn the vocabulary much faster the second time around. Relearning can be a more sensitive measure of memory than either recall or recognition because it allows assessing memory in terms of "how much" or "how fast" rather than simply "correct" versus "incorrect" responses. Relearning also allows us to measure memory for procedures like driving a car or playing a piano piece, as well as memory for facts and figures.

Implicit Memory

While explicit memory consists of the things that we can consciously report that we know, implicit memory refers to knowledge that we cannot consciously access. However, implicit memory is nevertheless exceedingly important to us because it has a direct effect on our behaviour. **Implicit memory** *refers to the influence of experience on behaviour, even if the individual is not aware of those influences*. As you can see in Figure 9.2, "Types of Memory," there are three general types of implicit memory: procedural memory, classical conditioning effects, and priming.

Procedural memory *refers to our often unexplainable knowledge of how to do things*. When we walk from one place

to another, speak to another person in English, dial a cell phone, or play a video game, we are using procedural memory. Procedural memory allows us to perform complex tasks, even though we may not be able to explain to others how we do them. There is no way to tell someone how to ride a bicycle; a person has to learn by doing it. The idea of implicit memory helps explain how infants are able to learn. The ability to crawl, walk and talk are procedures and these skills are easily and efficiently developed while we are children despite the fact that as adults we have no conscious memory of having learned them.

The second type of implicit memory is **classical conditioning effects**, in which we *learn, often without effort or awareness, to associate neutral stimuli (such as a sound or a light) with another stimulus (such as food), which creates a naturally occurring response, such as enjoyment or salivation*. The memory for the association is demonstrated when the conditioned stimulus (the sound) begins to create the same response as the unconditioned stimulus (the food) did before the learning.

The final type of implicit memory is known as **priming**, or *changes in behaviour as a result of experiences that have happened frequently or recently*. Priming refers both to the activation of knowledge (e.g., we can prime the concept of kindness by presenting people with words related to kindness) and to the influence of that activation on behaviour (people who are primed with the concept of kindness may act more kindly).

One measure of the influence of priming on implicit memory is the *word fragment test*, in which a person is asked to fill in missing letters to make words. You can try this yourself: First, try to complete the following word fragments, but work on each one for only three or four seconds. Do any words pop into mind quickly?

_ i b _ a _ y

_ h _ s _ _ i _ n

_ o _ k

_ h _ i s _

Now read the following sentence carefully:

“He got his materials from the shelves, checked them out, and then left the building.”

Then try again to make words out of the word fragments.

I think you might find that it is easier to complete fragments 1 and 3 as “library” and “book,” respectively, after you read the sentence than it was before you read it. However, reading the sentence didn’t really help you to complete fragments 2 and 4 as “physician” and “chaise.” This difference in implicit memory probably occurred because as you read the sentence, the concept of “library” (and perhaps “book”) was primed, even though they were never mentioned explicitly. Once a concept is primed it influences our behaviours, for instance, on word fragment tests.

Our everyday behaviours are influenced by priming in a wide variety of situations. Seeing an advertisement for cigarettes may make us start smoking, seeing the flag of our home country may arouse our patriotism, and seeing a student from a rival school may arouse our competitive spirit. And these influences on our behaviours may occur without our being aware of them.

Research Focus: Priming Outside Awareness Influences Behaviour

One of the most important characteristics of implicit memories is that they are frequently formed and used *automatically*, without much effort or awareness

on our part. In one demonstration of the automaticity and influence of priming effects, John Bargh and his colleagues (**Bargh, Chen, & Burrows, 1996**) conducted a study in which they showed undergraduate students lists of five scrambled words, each of which they were to make into a sentence. Furthermore, for half of the research participants, the words were related to stereotypes of the elderly. These participants saw words such as the following:

in Victoria retired live people
bingo man the forgetful plays

The other half of the research participants also made sentences, but from words that had nothing to do with elderly stereotypes. The purpose of this task was to prime stereotypes of elderly people in memory for some of the participants but not for others.

The experimenters then assessed whether the priming of elderly stereotypes would have any effect on the students' behaviour — and indeed it did. When the research participant had gathered all of his or her belongings, thinking that the experiment was over, the experimenter thanked him or her for participating and gave directions to the closest elevator. Then, without the participants knowing it, the experimenters recorded the amount of time that the participant spent walking from the doorway of the experimental room toward the elevator. As you can see in Figure 9.3, “Research Results.” participants who had made sentences using words related to elderly stereotypes took on the behaviours of the elderly — they walked

significantly more slowly as they left the experimental room.

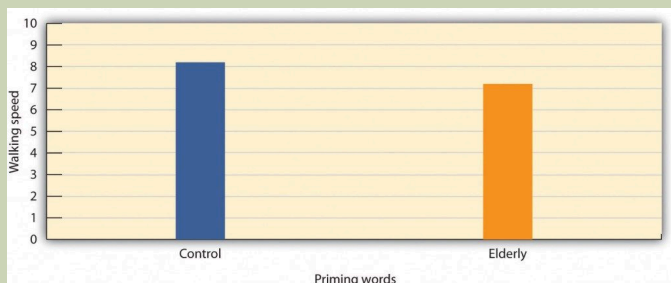


Figure 9.3 Research Results. Bargh, Chen, and Burrows found that priming words associated with the elderly made people walk more slowly (1996).

To determine if these priming effects occurred out of the awareness of the participants, Bargh and his colleagues asked still another group of students to complete the priming task and then to indicate whether they thought the words they had used to make the sentences had any relationship to each other, or could possibly have influenced their behaviour in any way. These students had no awareness of the possibility that the words might have been related to the elderly or could have influenced their behaviour.

Stages of Memory: Sensory, Short-Term, and Long-Term Memory

Another way of understanding memory is to think about it in terms of stages that describe the length of time that

information remains available to us. According to this approach (see Figure 9.4, “Memory Duration”), information begins in *sensory memory*, moves to *short-term memory*, and eventually moves to *long-term memory*. But not all information makes it through all three stages; most of it is forgotten. Whether the information moves from shorter-duration memory into longer-duration memory or whether it is lost from memory entirely depends on how the information is attended to and processed.

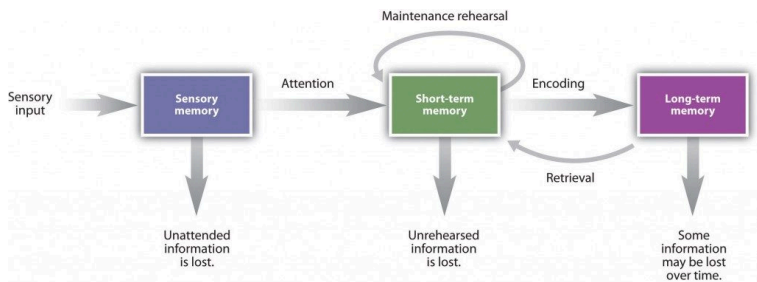


Figure 9.4 Memory Duration. Memory can be characterized in terms of stages — the length of time that information remains available to us. Adapted from Atkinson & Shiffrin ([pb_glossary id="4891"]1968[/pb_glossary]).

Sensory Memory

Sensory memory refers to the brief storage of sensory information. Sensory memory is a memory buffer that lasts only very briefly and then, unless it is attended to and passed on for more processing, is forgotten. The purpose of sensory memory is to give the brain some time to process the incoming sensations, and to allow us to see the world as an unbroken stream of events rather than as individual pieces.

Visual sensory memory is known as **iconic memory**. Iconic memory was first studied by the psychologist George Sperling (1960). In his research, Sperling showed participants a display of

letters in rows, similar to that shown in Figure 9.5, “Measuring Iconic Memory.” However, the display lasted only about 50 milliseconds ($1/20$ of a second). Then, Sperling gave his participants a recall test in which they were asked to name all the letters that they could remember. On average, the participants could remember only about one-quarter of the letters that they had seen.

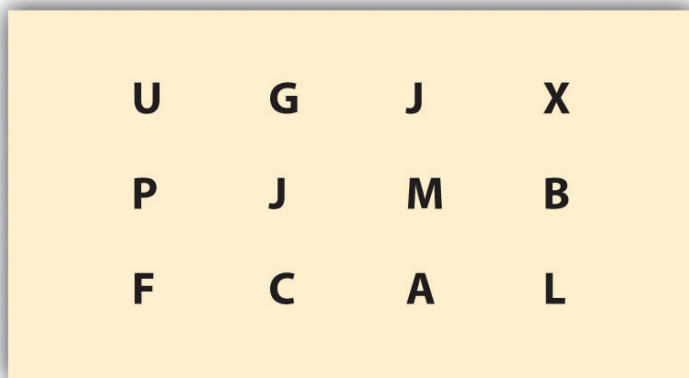


Figure 9.5 Measuring Iconic Memory. Sperling showed his participants displays such as this one for only $1/20$ th of a second. He found that when he cued the participants to report one of the three rows of letters, they could do it, even if the cue was given shortly after the display had been removed. The research demonstrated the existence of iconic memory. Adapted from Sperling ([pb_glossary id="4905"]1960[/pb_glossary]).

Sperling reasoned that the participants had seen all the letters but could remember them only very briefly, making it impossible for them to report them all. To test this idea, in his next experiment, he first showed the same letters, but then after the display had been removed, he signaled to the participants to report the letters from either the first, second, or third row. In this condition, the participants now reported almost all the letters in that row. This finding confirmed

Sperling's hunch: participants had access to all of the letters in their iconic memories, and if the task was short enough, they were able to report on the part of the display he asked them to. The "short enough" is the length of iconic memory, which turns out to be about 250 milliseconds ($\frac{1}{4}$ of a second).

Auditory sensory memory is known as **echoic memory**. In contrast to iconic memories, which decay very rapidly, echoic memories can last as long as four seconds (**Cowan, Lichty, & Grove, 1990**). This is convenient as it allows you — among other things — to remember the words that you said at the beginning of a long sentence when you get to the end of it, and to take notes on your psychology professor's most recent statement even after he or she has finished saying it.

In some people iconic memory seems to last longer, a phenomenon known as **eidetic imagery** (or *photographic memory*) in which *people can report details of an image over long periods of time*. These people, who often have diagnoses such as autism, claim that they can "see" an image long after it has been presented, and can often report accurately on that image. There is also some evidence for eidetic memories in hearing; some people report that their echoic memories persist for unusually long periods of time. The composer Wolfgang Amadeus Mozart may have possessed eidetic memory for music, because even when he was very young and had not yet had a great deal of musical training, he could listen to long compositions and then play them back almost perfectly (**Solomon, 1995**).

Short-Term Memory

Most of the information that gets into sensory memory is forgotten, but information that we turn our attention to, with the goal of remembering it, may pass into *short-term memory*. **Short-term memory (STM)** is *the place where small*

amounts of information can be temporarily kept for more than a few seconds but usually for less than one minute (Baddeley, Vallar, & Shallice, 1990). Information in short-term memory is not stored permanently but rather becomes available for us to process, and *the processes that we use to make sense of, modify, interpret, and store information in STM* are known as **working memory**.

Although it is called memory, working memory is not a store of memory like STM but rather a set of memory procedures or operations. Imagine, for instance, that you are asked to participate in a task such as this one, which is a measure of working memory (Unsworth & Engle, 2007). Each of the following questions appears individually on a computer screen and then disappears after you answer the question:

Is $10 \times 2 - 5 = 15$? (Answer YES OR NO) Then remember "S"

Is $12 \div 6 - 2 = 1$? (Answer YES OR NO) Then remember "R"

Is $10 \times 2 = 5$? (Answer YES OR NO) Then remember "P"

Is $8 \div 2 - 1 = 1$? (Answer YES OR NO) Then remember "T"

Is $6 \times 2 - 1 = 8$? (Answer YES OR NO) Then remember "U"

Is $2 \times 3 - 3 = 0$? (Answer YES OR NO) Then remember "Q"

To successfully accomplish the task, you have to answer each of the math problems correctly and at the same time remember the letter that follows the task. Then, after the six questions, you must list the letters that appeared in each of the trials in the correct order (in this case S, R, P, T, U, Q).

To accomplish this difficult task you need to use a variety of skills. You clearly need to use STM, as you must keep the letters in storage until you are asked to list them. But you also need a way to make the best use of your available attention and processing. For instance, you might decide to use a strategy of repeat the letters twice, then quickly solve the next problem, and then repeat the letters twice again including the new one.

Keeping this strategy (or others like it) going is the role of working memory's **central executive** — *the part of working memory that directs attention and processing*. The central executive will make use of whatever strategies seem to be best for the given task. For instance, the central executive will direct the rehearsal process, and at the same time direct the visual cortex to form an image of the list of letters in memory. You can see that although STM is involved, the processes that we use to operate on the material in memory are also critical.

Short-term memory is limited in both the length and the amount of information it can hold. Peterson and Peterson (1959) found that when people were asked to remember a list of three-letter strings and then were immediately asked to perform a distracting task (counting backward by threes), the material was quickly forgotten (see Figure 9.6, “STM Decay”), such that by 18 seconds it was virtually gone.

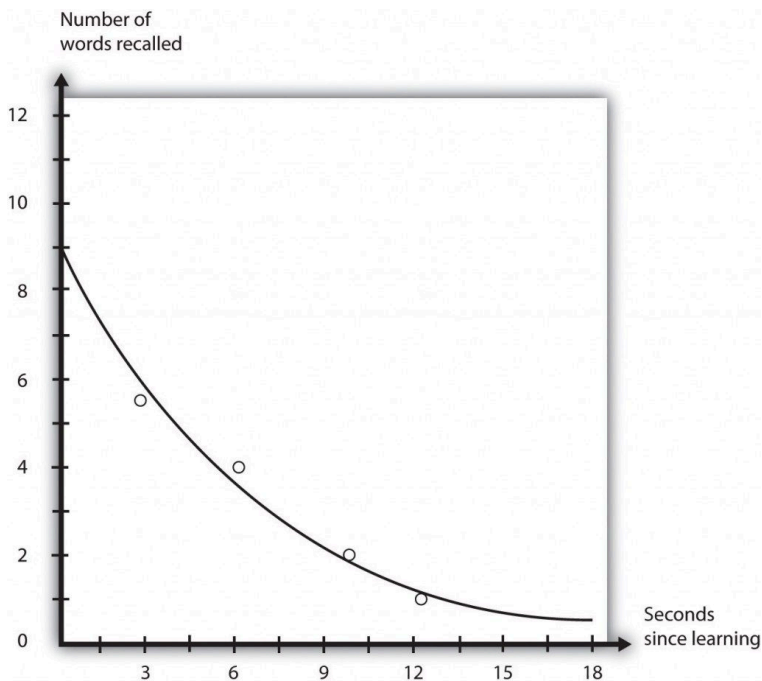


Figure 9.6 STM Decay. Researchers found that information that was not rehearsed decayed quickly from memory. Adapted from Peterson & Peterson ([pb_glossary id="4900"]1959[/pb_glossary]).

One way to prevent the decay of information from short-term memory is to use working memory to rehearse it. **Maintenance rehearsal** is the process of repeating information mentally or out loud with the goal of keeping it in memory. We engage in maintenance rehearsal to keep something that we want to remember (e.g., a person's name, email address, or phone number) in mind long enough to write it down, use it, or potentially transfer it to long-term memory.

If we continue to rehearse information, it will stay in STM until we stop rehearsing it, but there is also a capacity limit to STM. Try reading each of the following rows of numbers, one row at a time, at a rate of about one number each second. Then when

you have finished each row, close your eyes and write down as many of the numbers as you can remember.

019

3586

10295

861059

1029384

75674834

657874104

6550423897

If you are like the average person, you will have found that on this test of working memory, known as a *digit span test*, you did pretty well up to about the fourth line, and then you started having trouble. I bet you missed some of the numbers in the last three rows, and did pretty poorly on the last one.

The digit span of most adults is between five and nine digits, with an average of about seven. The cognitive psychologist George Miller (1956) referred to “seven plus or minus two” pieces of information as the magic number in short-term memory. But if we can only hold a maximum of about nine digits in short-term memory, then how can we remember larger amounts of information than this? For instance, how can we ever remember a 10-digit phone number long enough to dial it?

One way we are able to expand our ability to remember things in STM is by using a memory technique called *chunking*. **Chunking** is the process of organizing information into smaller groupings (chunks), thereby increasing the number of items that can be held in STM. For instance, try to remember this string of 12 letters:

XOFCBANNCVTM

You probably won’t do that well because the number of letters is more than the magic number of seven.

Now try again with this one:

CTVCBCTSNHBO

Would it help you if I pointed out that the material in this string could be chunked into four sets of three letters each? I think it would, because then rather than remembering 12 letters, you would only have to remember the names of four television stations. In this case, chunking changes the number of items you have to remember from 12 to only four.

Experts rely on chunking to help them process complex information. Herbert Simon and William Chase (1973) showed chess masters and chess novices various positions of pieces on a chessboard for a few seconds each. The experts did a lot better than the novices in remembering the positions because they were able to see the “big picture.” They didn’t have to remember the position of each of the pieces individually, but chunked the pieces into several larger layouts. But when the researchers showed both groups random chess positions — positions that would be very unlikely to occur in real games — both groups did equally poorly, because in this situation the experts lost their ability to organize the layouts (see Figure 9.7, “Possible and Impossible Chess Positions”). The same occurs for basketball. Basketball players recall actual basketball positions much better than do nonplayers, but only when the positions make sense in terms of what is happening on the court, or what is likely to happen in the near future, and thus can be chunked into bigger units (Didierjean & Marmèche, 2005).

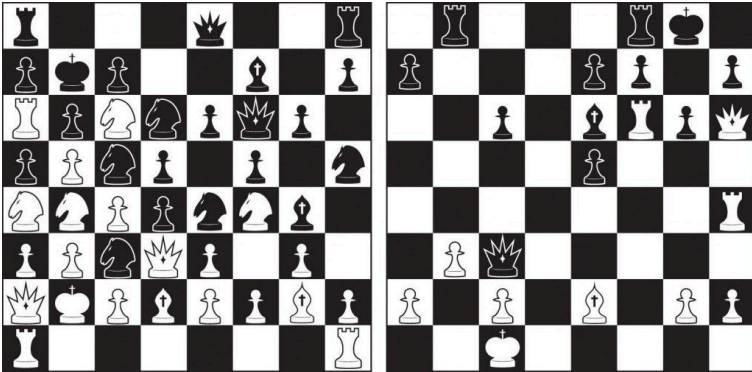


Figure 9.7 Possible and Impossible Chess Positions. Experience matters: Experienced chess players are able to recall the positions of the game on the right much better than are those who are chess novices. But the experts do no better than the novices in remembering the positions on the left, which cannot occur in a real game.

Key Takeaways

- Memory refers to the ability to store and retrieve information over time.
- For some things our memory is very good, but our active cognitive processing of information ensures that memory is never an exact replica of what we have experienced.
- Explicit memory refers to experiences that can be intentionally and consciously remembered, and it is measured using recall, recognition, and relearning. Explicit memory includes episodic and semantic memories.
- Measures of relearning (also known as

“savings”) assess how much more quickly information is learned when it is studied again after it has already been learned but then forgotten.

- Implicit memory refers to the influence of experience on behaviour, even if the individual is not aware of those influences. The three types of implicit memory are procedural memory, classical conditioning, and priming.
- Information processing begins in sensory memory, moves to short-term memory, and eventually moves to long-term memory.
- Maintenance rehearsal and chunking are used to keep information in short-term memory.
- The capacity of long-term memory is large, and there is no known limit to what we can remember.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Central executive

The part of working memory that directs attention and processing

Chunking

The process of organizing information into smaller groupings (chunks), thereby increasing the number of items that can be held in STM

Classical conditioning effects

We learn, often without effort or awareness, to associate neutral stimuli (such as a sound or a light) with another stimulus (such as food), which creates a naturally occurring response, such as enjoyment or salivation

Echoic memory

Auditory sensory memory

Eidetic imagery

When people can report details of an image over long periods of time (also known as photographic memory)

Episodic memory

The ability to learn and retrieve new information or episodes in one's life.

Explicit memory

Knowledge or experiences that can be consciously remembered

Iconic memory

Visual sensory memory

Implicit memory

A type of long-term memory that does not require conscious thought to encode. It's the type of memory one makes without intent.

Long-term memory

Storage of information over an extended period

Maintenance rehearsal

The process of repeating information mentally or out loud with the goal of keeping it in memory.

Memory stages

Sensory, short-term, and long-term

Priming

The activation of certain thoughts or feelings that make them easier to think of and act upon

Procedural memory

Our often unexplainable knowledge of how to do things

Recall memory

A measure of explicit memory that involves bringing from memory information that has previously been remembered

Recognition memory test

A measure of explicit memory that involves determining whether information has been seen or learned before

Relearning

Assesses how much more quickly information is processed or learned when it is studied again after it has already been learned but then forgotten

Semantic memory

The more or less permanent store of knowledge that people have.

Sensory memory

The brief storage of sensory information

Short-term memory (STM)

The place where small amounts of information can be temporarily kept for more than a few seconds but usually for less than one minute

Types of memory

Explicit memory and implicit memory

Working memory

The form of memory we use to hold onto information temporarily, usually for the purposes of manipulation.

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29. Accuracy and Inaccuracy in Perception

Original chapter by Charles Stangor with adaptations by Jennifer Walinga, adapted by the Queen's University Psychology Department

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

You'll notice that this chapter looks a bit different from our earlier chapters. A benefit of an Open Access textbook is that we have the ability to source and adapt content written by experts globally that address issues that are important for our course. This chapter is from the text “Introduction to Psychology–1st Canadian Edition.” You can find the book [here](#).

Learning Objectives

- Describe how sensation and perception work together through sensory interaction, selective attention, sensory adaptation, and perceptual constancy.
- Give examples of how our expectations may influence our perception, resulting in illusions and potentially inaccurate

judgments.

The eyes, ears, nose, tongue, and skin sense the world around us, and in some cases perform preliminary information processing on the incoming data. But by and large, we do not experience sensation — we experience the outcome of perception, the total package that the brain puts together from the pieces it receives through our senses and that the brain creates for us to experience. When we look out the window at a view of the countryside, or when we look at the face of a good friend, we don't just see a jumble of colours and shapes — we see, instead, an image of a countryside or an image of a friend (**Goodale & Milner, 2006**).

How the Perceptual System Interprets the Environment

This meaning making involves the automatic operation of a variety of essential perceptual processes. One of these is **sensory interaction** — *the working together of different senses to create experience*. Sensory interaction is involved when taste, smell, and texture combine to create the flavour we experience in food. It is also involved when we enjoy a movie because of the way the images and the music work together.

Although you might think that we understand speech only through our sense of hearing, it turns out that the visual aspect of speech is also important. One example of sensory interaction is shown in the **McGurk effect** — *an error in perception that occurs when we misperceive sounds because the audio and visual parts of the speech are mismatched*. You can witness the effect yourself by viewing “The McGurk Effect.”

Watch The McGurk Effect
[YouTube]:<http://www.youtube.com/watch?v=jtsfidRq2tw>



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The McGurk effect is an error in sound perception that occurs when there is a mismatch between the senses of hearing and seeing. You can experience it here.

Other examples of sensory interaction include the experience of nausea that can occur when the sensory information being received from the eyes and the body does not match information from the vestibular system (**Flanagan, May, & Dobie, 2004**) and **synesthesia** — *an experience in which one sensation (e.g., hearing a sound) creates experiences in another (e.g., vision)*. Most people do not experience synesthesia, but those who do link their perceptions in unusual ways, for instance, by experiencing colour when they taste a particular food or by hearing sounds when they see certain objects (**Ramachandran, Hubbard, Robertson, & Sagiv, 2005**).

Another important perceptual process is **selective attention** — *the ability to focus on some sensory inputs while tuning out others*. View “Video Clip: Selective Attention,” and count the number of times the people in white playing with the ball pass it to each other. You may find that, like many other people who view it for the first time, you miss something

important because you selectively attend to only one aspect of the video (**Simons & Chabris, 1999**).

Watch Selective Attention
[YouTube]:<http://www.youtube.com/watch?v=vJG698U2Mvo>



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Watch this video and carefully count how many times the people in white pass the ball to each other.

Selective attention also allows us to focus on a single talker at a party while ignoring other conversations that are occurring around us (**Broadbent, 1958; Cherry, 1953**). Without this automatic selective attention, we'd be unable to focus on the single conversation we want to hear. But selective attention is not complete; we also, at the same time, monitor what's happening in the channels we are not focusing on. Perhaps you have had *the experience of being at a party and talking to someone in one part of the room, when suddenly you hear your name being mentioned by someone in another part of the room*. This **cocktail party phenomenon** shows us that although selective attention is limiting what we process, we are nevertheless simultaneously doing a lot of unconscious monitoring of the world around us — you didn't know you were attending to the background sounds of the party, but evidently you were.

A second fundamental process of perception is **sensory**

adaptation — *a decreased sensitivity to a stimulus after prolonged and constant exposure.* When you step into a swimming pool, the water initially feels cold, but after a while you stop noticing it. After prolonged exposure to the same stimulus, our sensitivity toward it diminishes and we no longer perceive it. The ability to adapt to the things that don't change around us is essential to our survival, as it leaves our sensory receptors free to detect the important and informative changes in our environment and to respond accordingly. We ignore the sounds that our car makes every day, which leaves us free to pay attention to the sounds that are different from normal, and thus likely to need our attention. Our sensory receptors are alert to novelty and are fatigued after constant exposure to the same stimulus.

If sensory adaptation occurs with all senses, why doesn't an image fade away after we stare at it for a period of time? The answer is that, although we are not aware of it, our eyes are constantly flitting from one angle to the next, making *thousands of tiny movements* (called **saccades**) every *minute*. This constant eye movement guarantees that the image we are viewing always falls on fresh receptor cells. What would happen if we could stop the movement of our eyes? Psychologists have devised a way of testing the sensory adaptation of the eye by attaching an instrument that ensures a constant image is maintained on the eye's inner surface. Participants are fitted with a contact lens that has a miniature slide projector attached to it. Because the projector follows the exact movements of the eye, the same image is always projected, stimulating the same spot, on the retina. Within a few seconds, interesting things begin to happen. The image will begin to vanish, then reappear, only to disappear again, either in pieces or as a whole. Even the eye experiences sensory adaptation (**Yarbus, 1967**).

One of the major problems in perception is to ensure that we always perceive the same object in the same way, even

when the sensations it creates on our receptors change dramatically. *The ability to perceive a stimulus as constant despite changes in sensation* is known as **perceptual constancy**. Consider our image of a door as it swings. When it is closed, we see it as rectangular, but when it is open, we see only its edge and it appears as a line. But we never perceive the door as changing shape as it swings — perceptual mechanisms take care of the problem for us by allowing us to see a constant shape.

The visual system also corrects for colour constancy. Imagine that you are wearing blue jeans and a bright white T-shirt. When you are outdoors, both colours will be at their brightest, but you will still perceive the white T-shirt as bright and the blue jeans as darker. When you go indoors, the light shining on the clothes will be significantly dimmer, but you will still perceive the T-shirt as bright. This is because we put colours in context and see that, compared with its surroundings, the white T-shirt reflects the most light (**McCann, 1992**). In the same way, a green leaf on a cloudy day may reflect the same wavelength of light as a brown tree branch does on a sunny day. Nevertheless, we still perceive the leaf as green and the branch as brown.

Illusions

Although our perception is very accurate, it is not perfect. **Illusions** occur when the perceptual processes that normally help us correctly perceive the world around us are fooled by a particular situation so that we see something that does not exist or that is incorrect. Figure 5.23, “Optical Illusions as a Result of Brightness Constancy (Left) and Colour Constancy (Right),” presents two situations in which our normally accurate perceptions of visual constancy have been fooled.

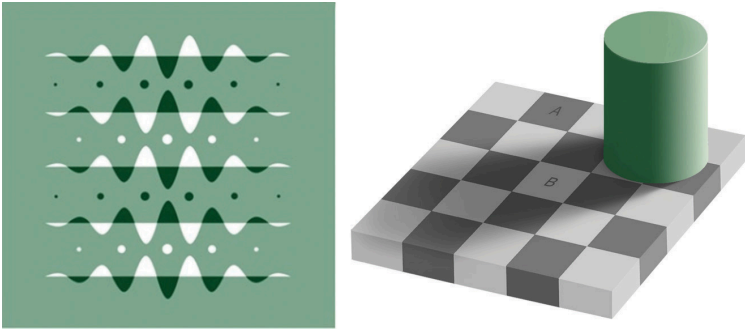


Figure 5.23 Optical Illusions as a Result of Brightness Constancy (Left) and Colour Constancy (Right). Look carefully at the snakelike pattern on the left. Are the green strips really brighter than the background? Cover the white curves and you'll see they are not. Square A in the right-hand image looks very different from square B, even though they are exactly the same.

Another well-known illusion is the **Mueller-Lyer illusion** (see Figure 5.24, “The Mueller-Lyer Illusion”). *The line segment in the bottom arrow looks longer to us than the one on the top, even though they are both actually the same length.* It is likely that the illusion is, in part, the result of the failure of monocular depth cues — the bottom line looks like an edge that is normally farther away from us, whereas the top one looks like an edge that is normally closer.

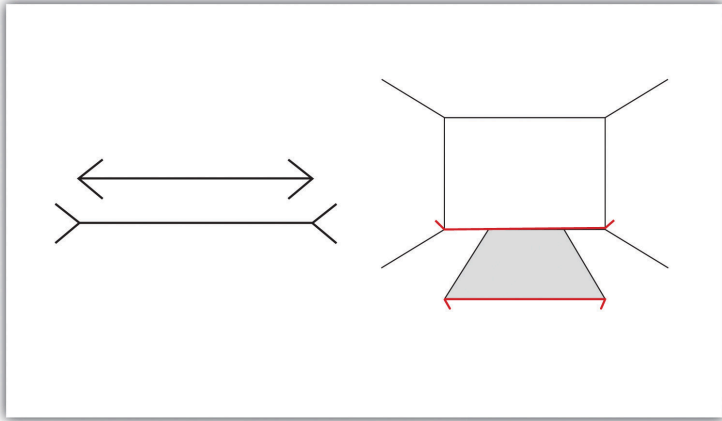


Figure 5.24 The Mueller-Lyer Illusion. The Mueller-Lyer illusion makes the line segment at the top of the left picture appear shorter than the one at the bottom. The illusion is caused, in part, by the monocular distance cue of depth — the bottom line looks like an edge that is normally farther away from us, whereas the top one looks like an edge that is normally closer.

The **moon illusion** refers to the fact that *the moon is perceived to be about 50% larger when it is near the horizon than when it is seen overhead, despite the fact that in both cases the moon is the same size and casts the same size retinal image.* The monocular depth cues of position and aerial perspective (see Figure 5.25, “The Moon Illusion”) create the illusion that things that are lower and more hazy are farther away. The skyline of the horizon (trees, clouds, outlines of buildings) also gives a cue that the moon is far away, compared to when it is at its zenith. If we look at a horizon moon through a tube of rolled-up paper, taking away the surrounding horizon cues, the moon will immediately appear smaller.



Figure 5.25 The Moon Illusion. The moon always looks larger on the horizon than when it is high above. But if we take away the surrounding distance cues of the horizon, the illusion disappears.

The *Ponzo illusion* operates on the same principle. As you can see in Figure 5.26, “The Ponzo Illusion,” the top yellow bar seems longer than the bottom one, but if you measure them you’ll see that they are exactly the same length. The monocular depth cue of linear perspective leads us to believe that, given two similar objects, the distant one can only cast the same size retinal image as the closer object if it is larger. The topmost bar therefore appears longer.

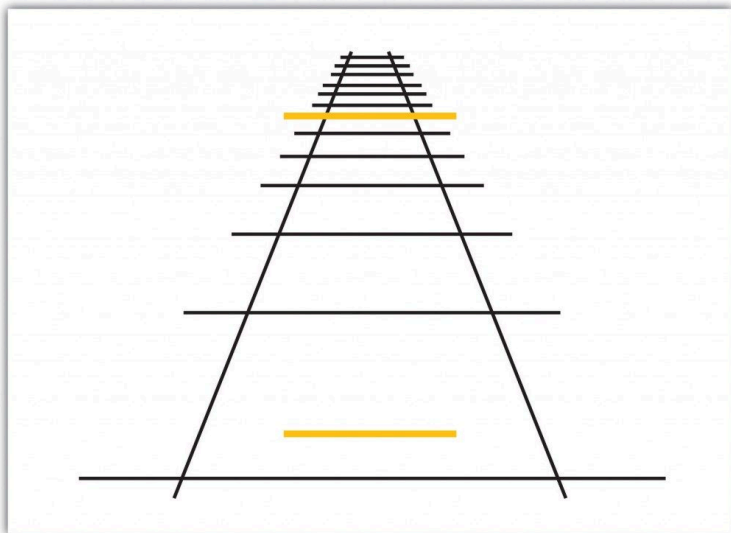


Figure 5.26 The Ponzo Illusion. The Ponzo illusion is caused by a failure of the monocular depth cue of linear perspective. Both bars are the same size, even though the top one looks larger.

Illusions demonstrate that our perception of the world around us may be influenced by our prior knowledge. But the fact that some illusions exist in some cases does not mean that the perceptual system is generally inaccurate — in fact, humans normally become so closely in touch with their environment that the physical body and the particular environment that we sense and perceive becomes **embodied** — *that is, built into and linked with our cognition, such that the world around us becomes part of our brain* (Calvo & Gomila, 2008). The close relationship between people and their environments means that, although illusions can be created in the lab and under some unique situations, they may be less common with active observers in the real world (Runeson, 1988).

The Important Role of Expectations in Perception

Our emotions, mindset, expectations, and the contexts in which our sensations occur all have a profound influence on perception. People who are warned that they are about to taste something bad rate what they do taste more negatively than people who are told that the taste won't be so bad (**Nitschke et al., 2006**), and people perceive a child and adult pair as looking more alike when they are told that they are parent and child (**Bressan & Dal Martello, 2002**). Similarly, participants who see images of the same baby rate it as stronger and bigger when they are told it is a boy as opposed to when they are told it is a girl (**Stern & Karraker, 1989**), and research participants who learn that a child is from a lower-class background perceive the child's scores on an intelligence test as lower than people who see the same test taken by a child they are told is from an upper-class background (**Darley & Gross, 1983**). Plassmann, O'Doherty, Shiv, and Rangel (**2008**) found that wines were rated more positively and caused greater brain activity in brain areas associated with pleasure when they were said to cost more than when they were said to cost less. And even experts can be fooled: professional referees tended to assign more penalty cards to soccer teams for videotaped fouls when they were told that the team had a history of aggressive behaviour than when they had no such expectation (**Jones, Paull, & Erskine, 2002**).

Our perceptions are also influenced by our desires and motivations. When we are hungry, food-related words tend to grab our attention more than non-food-related words (**Mogg, Bradley, Hyare, & Lee, 1998**), we perceive objects that we can reach as bigger than those that we cannot reach (**Witt & Proffitt, 2005**), and people who favour a political candidate's policies view the candidate's skin colour more positively than

do those who oppose the candidate's policies (**Caruso, Mead, & Balcetis, 2009**). Even our culture influences perception. Chua, Boland, and Nisbett (**2005**) showed American and Asian graduate students different images, such as an airplane, an animal, or a train, against complex backgrounds. They found that (consistent with their overall individualistic orientation) the American students tended to focus more on the foreground image, while Asian students (consistent with their interdependent orientation) paid more attention to the image's context. Furthermore, Asian-American students focused more or less on the context depending on whether their Asian or their American identity had been activated.

*Psychology in Everyday Life: How Understanding
Sensation and Perception Can Save Lives*

Human factors is the *field of psychology that uses psychological knowledge, including the principles of sensation and perception, to improve the development of technology*. Human factors has worked on a variety of projects, ranging from nuclear reactor control centres and airplane cockpits to cell phones and websites (**Proctor & Van Zandt, 2008**). For instance, modern televisions and computer monitors were developed on the basis of the trichromatic colour theory, using three colour elements placed close enough together that the colours are blended by the eye. Knowledge of the visual system also helped engineers create new kinds of displays, such as those used on notebook computers and music players, and better understand how using cell phones while driving

may contribute to automobile accidents (**Lee & Strayer, 2004**).

Human factors also has made substantial contributions to airline safety. About two-thirds of accidents on commercial airplane flights are caused by human error (**Nickerson, 1998**). During takeoff, travel, and landing, the pilot simultaneously communicates with ground control, maneuvers the plane, scans the horizon for other aircraft, and operates controls. The need for a usable interface that works easily and naturally with the pilot's visual perception is essential.

Psychologist Conrad Kraft (**1978**) hypothesized that as planes land, with no other distance cues visible, pilots may be subjected to a type of moon illusion, in which the city lights beyond the runway appear much larger on the retina than they really are, deceiving the pilot into landing too early. Kraft's findings caused airlines to institute new flight safety measures, where copilots must call out the altitude progressively during the descent, which has probably decreased the number of landing accidents.

Figure 5.27 presents images of an airplane instrument panel before and after it was redesigned by human factors psychologists. On the left is the initial design, in which the controls were crowded and cluttered, in no logical sequence, each control performing one task. The controls were more or less the same in colour, and the gauges were not easy to read. The redesigned digital cockpit (right on Figure 5.27) shows a marked improvement in usability. More of the controls are colour-coded and multifunctional so that there is less clutter on the dashboard. Screens

make use of LCD and 3-D graphics. Text sizes are changeable — increasing readability — and many of the functions have become automated, freeing up the pilots' concentration for more important activities.



Figure 5.27 Airplane Cockpits. Initial design of the airplane cockpit (left); the digital design of the airplane cockpit (right), which has taken human factors into account.

One important aspect of the redesign was based on the principles of sensory adaptation. Displays that are easy to see in darker conditions quickly become unreadable when the sun shines directly on them. It takes the pilot a relatively long time to adapt to the suddenly much brighter display. Furthermore, perceptual contrast is important. The display cannot be so bright at night that the pilot is unable to see targets in the sky or on the land. Human factors psychologists used these principles to determine the appropriate stimulus intensity needed on these displays so that pilots would be able to read them accurately and quickly under a wide range of conditions. The psychologists accomplished this by developing an automatic control mechanism that senses the ambient light visible through the front cockpit windows and

detects the light falling on the display surface, and then automatically adjusts the intensity of the display for the pilot (**Silverstein, Krantz, Gomer, Yeh, & Monty, 1990; Silverstein & Merrifield, 1985**).

Key Takeaways

- Sensory interaction occurs when different senses work together, for instance, when taste, smell, and touch together produce the flavour of food.
- Selective attention allows us to focus on some sensory experiences while tuning out others.
- Sensory adaptation occurs when we become less sensitive to some aspects of our environment, freeing us to focus on more important changes.
- Perceptual constancy allows us to perceive an object as the same, despite changes in sensation.
- Cognitive illusions are examples of how our expectations can influence our perceptions.
- Our emotions, motivations, desires, and even our culture can influence our perceptions.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily

address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Cocktail party phenomenon

The experience of being at a party and talking to someone in one part of the room, when suddenly you hear your name being mentioned by someone in another part of the room

Embodied

Built into and linked with our cognition

Illusions

Occur when the perceptual processes that normally help us correctly perceive the world around us are fooled by a particular situation so that we see something that does not exist or that is incorrect.

McGurk effect

An effect in which conflicting visual and auditory components of a speech stimulus result in an illusory percept.

Moon illusion

The fact that the moon is perceived to be about 50% larger when it is near the horizon than when it is seen overhead, despite the fact that in both cases the moon is the same size and casts the same size retinal image.

Mueller-Lyer illusion

The line segment in the bottom arrow looks longer to us than the one on the top, even though they are both actually the same length.

Perceptual constancy

The ability to perceive a stimulus as constant despite changes in sensation

Saccades

Quick, simultaneous movements of the eyes

Selective attention

The ability to select certain stimuli in the environment to process, while ignoring distracting information.

Sensory adaptation

Decrease in sensitivity of a receptor to a stimulus after constant stimulation.

Sensory interaction

The working together of different senses to create experience

Synesthesia

An experience in which one sensation (e.g., hearing a sound) creates experiences in another (e.g., vision).

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30. Failures of Awareness: The Case of Inattentional Blindness

Original chapter by Daniel Simons adapted by the Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen’s Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

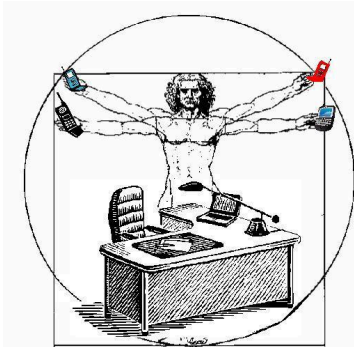
We think important objects and events in our world will automatically grab our attention, but they often don’t, particularly when our attention is focused on something else. The failure to notice unexpected objects or events when attention is focused elsewhere is now known as inattentional blindness. The study of such failures of awareness has a long history, but their practical importance has received increasing attention over the past decade. This module describes the history and status of research on inattentional blindness, discusses the reasons why we find these results to be counterintuitive, and the implications of failures of awareness for how we see and act in our world.

Learning Objectives

- Learn about inattentional blindness and why it occurs.
- Identify ways in which failures of awareness are counterintuitive.
- Better understand the link between focused attention and failures of awareness.

Do you regularly spot editing errors in movies? Can you multitask effectively, texting while talking with your friends or watching television? Are you fully aware of your surroundings? If you answered yes to any of those questions, you're not alone. And, you're most likely wrong. More than 50 years ago, experimental psychologists began documenting the many ways that our perception of the world is limited, not by our eyes and ears, but by our minds. We appear able to process only one stream of information at a time, effectively filtering other information from awareness. To a large extent, we perceive only that which receives the focus of our cognitive efforts: our attention.

Imagine the following task, known as **dichotic listening** (e.g., **Cherry, 1953; Moray, 1959; Treisman, 1960**): You put on a set of headphones that play two completely different speech streams, one to your left ear and one to your right ear. Your task is to repeat each syllable spoken into your left ear as quickly and accurately as possible, mimicking each sound as you hear it. When performing this attention-demanding task, you won't notice if the speaker in your right ear switches to a different language or is replaced by a different speaker with a similar voice. You won't notice if the content of their speech becomes nonsensical. In effect, you are deaf to the substance of the ignored speech. But, that is not because of the limits of your auditory senses. It is a form of cognitive deafness, due to the nature of focused, selective attention. Even if the speaker on



Some researchers contend that there really is no such thing as multi-tasking. Instead, people are just rapidly switching their attention between tasks, rather than holding those tasks in their attention at the same time.

[Image: Mike Licht, <https://goo.gl/z7rkve>, CC BY 2.0, <https://goo.gl/v4Y0Zv>]

your right headphone says your name, you will notice it only about one-third of the time (**Conway, Cowan, & Bunting, 2001**). And, at least by some accounts, you only notice it that often because you still devote some of your limited attention to the ignored speech stream. In this task, you will tend to notice only large physical changes (e.g., a switch from a male to a female speaker), but not substantive ones, except in rare cases.

This **selective**

listening task highlights the

power of attention to filter extraneous information from awareness while letting in only those elements of our world that we want to hear. Focused attention is crucial to our powers of observation, making it possible for us to zero in on what we want to see or hear while filtering out irrelevant distractions. But, it has consequences as well: We can miss what would otherwise be obvious and important signals.

The same pattern holds for vision. In a groundbreaking series of studies in the 1970s and early 1980s, Neisser and his colleagues devised a visual analogue of the dichotic listening task (**Neisser & Becklen, 1975**). Their subjects viewed a video of two distinct, but partially transparent and overlapping, events. For example, one event might involve two people playing a hand-clapping game and the other might show people passing a ball. Because the two events were partially transparent and overlapping, both produced sensory signals on the retina regardless of which event received the

participant's attention. When participants were asked to monitor one of the events by counting the number of times the actors performed an action (e.g., hand clapping or completed passes), they often failed to notice unexpected events in the ignored video stream (e.g., the hand-clapping players stopping their game and shaking hands). As for dichotic listening, the participants were unaware of events happening outside the focus of their attention, even when looking right at them. They could tell that other "stuff" was happening on the screen, but many were unaware of the meaning or substance of that stuff.

To test the power of selective attention to induce failures of awareness, Neisser and colleagues (**Neisser, 1979**) designed a variant of this task in which participants watched a video of two teams of players, one wearing white shirts and one wearing black shirts. Subjects were asked to press a key whenever the players in white successfully passed a ball, but to ignore the players in black. As for the other videos, the teams were filmed separately and then superimposed so that they literally occupied the same



Have you ever been paying attention to something so closely you missed another event in the background? Or have you ever been so used to seeing something a certain way that when it changed, you didn't even notice it had? [Image: Tilde Ann Thurium, <https://goo.gl/pb8l6Q>, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

space (they were partially transparent). Partway through the video, a person wearing a raincoat and carrying an umbrella strolled through the scene. People were so intently focused on spotting passes that they often missed the "umbrella woman." (Pro tip: If you look closely at the video, you'll see that Ulric Neisser plays on both the black and white teams.)

These surprising findings were well known in the field, but for decades, researchers dismissed their implications because the displays had such an odd, ghostly appearance. Of course, we would notice if the displays were fully opaque and vivid rather than partly transparent and grainy. Surprisingly, no studies were built on Neisser's method for nearly 20 years. Inspired by these counterintuitive findings and after discussing them with Neisser himself, Christopher Chabris and I revisited them in the late 1990s (**Simons & Chabris, 1999**). We replicated Neisser's work, again finding that many people missed the umbrella woman when all of the actors in the video were partially transparent and occupying the same space. But, we added another wrinkle: a version of the video in which all of the actions of both teams of players were choreographed and filmed with a single camera. The players moved in and around each other and were fully visible. In the most dramatic version, we had a woman in a gorilla suit walk into the scene, stop to face the camera, thump her chest, and then walk off the other side after nine seconds on screen. Fully half the observers missed the gorilla when counting passes by the team in white.

This phenomenon is now known as **inattention blindness**, the surprising failure to notice an unexpected object or event when attention is focused on something else (Mack & Rock, **1998**). The past 15 years has seen a surge of interest in such failures of awareness, and we now have a better handle on the factors that cause people to miss unexpected events as well as the range of situations in which inattention blindness occurs. People are much more likely to notice unexpected objects that share features with the attended items in a display (**Most et al., 2001**). For example, if you count passes by the players wearing black, you are more likely to notice the gorilla than if you count passes by the players wearing white because the color of the gorilla more closely matches that of the black-shirted players (**Simons & Chabris, 1999**). However, even unique items can go unnoticed. In one task, people monitored black shapes and

ignored white shapes that moved around a computer window (**Most et al., 2001**). Approximately 30 percent of them failed to detect the bright red cross traversing the display, even though it was the only colored item and was visible for five seconds.



The more effort a cognitive task requires the more likely it becomes that you'll miss noticing something significant. [Image: CC0 Public Domain, <https://goo.gl/m25gce>]

Another crucial influence on noticing is the effort you put into the attention-demanding task. If you have to keep separate counts of bounce passes and aerial passes, you are less likely to notice the gorilla (**Simons & Chabris, 1999**), and if you are tracking faster moving objects, you are less likely to notice slower moving objects (**Simons & Jensen, 2009**). You can even miss unexpected visual objects when you devote your

limited cognitive resources to a memory task (**Fougnie & Marois, 2007**), so the limits are not purely visual. Instead, they appear to reflect limits on the capacity of attention. Without attention to the unexpected event, you are unlikely to become aware of it (Mack & Rock, **1998**; Most, Scholl, Clifford, & Simons, **2005**).

Inattention blindness is not just a laboratory curiosity—it also occurs in the real world and under more natural conditions. In a recent study (**Chabris, Weinberger, Fontaine, & Simons, 2011**), Chabris and colleagues simulated a famous police misconduct case in which a Boston police officer was convicted of lying because he claimed not to have seen a brutal beating. At the time, he had been chasing a murder suspect and ran right past the scene of a brutal assault. In Chabris' simulation, subjects jogged behind an experimenter who ran

right past a simulated fight scene. At night, 65 percent missed the fight scene. Even during broad daylight, 44 percent of observers jogged right passed it without noticing, lending some plausibility to the Boston cop's story that he was telling the truth and never saw the beating.

Perhaps more importantly, auditory distractions can induce real-world failures to see. Although people believe they can multitask, few can. And, talking on a phone while driving or walking decreases situation awareness and increases the chances that people will miss something important (**Strayer & Johnston, 2001**). In a dramatic illustration of cell phone-induced inattention blindness, Ira Hyman observed that people talking on a cell phone as they walked across a college campus were less likely than other pedestrians to notice a unicycling clown who rode across their path (**Hyman, Boss, Wise, McKenzie, & Caggiano, 2010**).

Recently, the study of this sort of awareness failure has returned to its roots in studies of listening, with studies documenting **inattention deafness**: When listening to a set of spatially localized conversations over headphones, people often fail to notice the voice of a person walking through the scene repeatedly stating "I am a gorilla" (**Dalton & Fraenkel, 2012**). Under conditions of focused attention, we see and hear far less of the unattended information than we might expect (**Macdonald & Lavie, 2011; Wayand, Levin, & Varakin, 2005**).

We now have a good understanding of the ways in which focused attention affects the detection of unexpected objects falling outside that focus. The greater the demands on attention, the less likely people are to notice objects falling outside their attention (**Macdonald & Lavie, 2011; Simons & Chabris, 1999; Simons & Jensen, 2009**). The more like the ignored elements of a scene, the less likely people are to notice. And, the more distracted we are, the less likely we are to be aware of our surroundings. Under conditions of distraction, we effectively develop tunnel vision.

Despite this growing understanding of the limits of attention and the factors that lead to more or less noticing, we have relatively less understanding of individual differences in noticing (Simons & Jensen, 2009). Do some people consistently notice the unexpected while others are obviously unaware of their surroundings? Or, are we all subject to inattentional blindness due to structural limits on the nature of attention? The question



Now you see me, now you don't! Although the research on attention has only developed over the last few decades, magicians have been taking advantages of our susceptibility to misguided focus for centuries. [Image: ShahanB, <https://goo.gl/p5DYXH>, CC BY-SA 3.0, <https://goo.gl/eLCn2O>]

remains controversial. A few studies suggest that those people who have a greater working memory capacity are more likely to notice unexpected objects (Richards, Hannon, & Derakshan, 2010). In effect, those who have more resources available when focusing attention are more likely to spot other aspects of their world. However, other studies find no such relationship: Those with greater working memory capacity are not any more likely to spot an unexpected object or event (Seegmiller, Watson, & Strayer, 2011; Bredemeier & Simons, 2012). There are theoretical reasons to predict each pattern. With more resources available, people should be more likely to notice (see Macdonald & Lavie, 2011). However, people with greater working memory capacity also tend to be better able to maintain their focus on their prescribed task, meaning that they should be less likely to notice. At least one study suggests that the ability to perform a task does not predict the likelihood of noticing (Simons & Jensen, 2009; for a replication, see Bredemeier & Simons, 2012). In a study I conducted with Melinda Jensen, we

measured how well people could track moving objects around a display, gradually increasing the speed until people reached a level of 75% accuracy. Tracking ability varied greatly: Some people could track objects at more than twice the speed others could. Yet, the ability to track objects more easily was unrelated to the odds of noticing an unexpected event. Apparently, as long as people try to perform the tracking task, they are relatively unlikely to notice unexpected events.

What makes these findings interesting and important is that they run counter to our intuitions. Most people are confident they would notice the chest-thumping gorilla. In fact, nearly 90% believe they would spot the gorilla (**Levin & Angelone, 2008**), and in a national survey, 78% agreed with the statement, “People generally notice when something unexpected enters their field of view, even when they’re paying attention to something else” (**Simons & Chabris, 2010**). Similarly, people are convinced that they would spot errors in movies or changes to a conversation partner (**Levin & Angelone, 2008**). We think we see and remember far more of our surroundings than we actually do. But why do we have such mistaken intuitions?

One explanation for this mistaken intuition is that our experiences themselves mislead us (**Simons & Chabris, 2010**). We rarely experience a study situation such as the gorilla experiment in which we are forced to confront something obvious that we just missed. That partly explains why demonstrations such as that one are so powerful: We expect that we would notice the gorilla, and we cannot readily explain away our failure to notice it. Most of the time, we are happily unaware of what we have missed, but we are fully aware of those elements of a scene that we have noticed. Consequently, if we assume our experiences are representative of the state of the world, we will conclude that we notice unexpected events. We don’t easily think about what we’re missing.

Given the limits on attention coupled with our mistaken impression that important events will capture our attention,

how has our species survived? Why weren't our ancestors eaten by unexpected predators? One reason is that our ability to focus attention intently might have been more evolutionarily useful than the ability to notice unexpected events. After all, for an event to be unexpected, it must occur relatively infrequently. Moreover, most events don't require our immediate attention, so if inattentional blindness delays our ability to notice the events, the consequences could well be minimal. In a social context, others might notice that event and call attention to it. Although inattentional blindness might have had minimal consequences over the course of our evolutionary history, it does have consequences now.

At pedestrian speeds and with minimal distraction, inattentional blindness might not matter for survival. But in modern society, we face greater distractions and move at greater speeds, and even a minor delay in noticing something unexpected can mean the difference between a fender-bender and a lethal collision. If talking on a phone increases your odds of missing a unicycling clown, it likely also increases your odds of missing the child who runs into the street or the car that runs a red light. Why, then, do people continue to talk on the phone when driving? The reason might well be the same mistaken intuition that makes inattentional blindness surprising: Drivers simply do not notice how distracted they are when they are talking on a phone, so they believe they can drive just as well when talking on a phone even though they can't (**Strayer & Johnston, 2001**).

So, what can you do about inattentional blindness? The short answer appears to be, "not much." There is no magical elixir that will overcome the limits on attention, allowing you to notice everything (and that would not be a good outcome anyway). But, there is something you can do to mitigate the consequences of such limits. Now that you know about inattentional blindness, you can take steps to limit its impact by recognizing how your intuitions will lead you astray.



Even though you may think you can drive, text, listen to music, and drink a smoothie at the same time, really, your focus should be only on the road. Everything else is a potential distraction from what's most important: driving safely!
[Image: FMHS The Buzz TV, <https://goo.gl/Tsk2RP>, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

First, maximize the attention you do have available by avoiding distractions, especially under conditions for which an unexpected event might be catastrophic. The ring of a new call or the ding of a new text are hard to resist, so make it impossible to succumb to the temptation by turning your phone off or putting it somewhere out of reach when you are driving. If you know that you will be tempted and you know that using your phone will increase inattentional

blindness, you must be proactive. Second, pay attention to what others might not notice. If you are a bicyclist, don't assume that the driver sees you, even if they appear to make eye contact. Looking is not the same as seeing. Only by understanding the limits of attention and by recognizing our mistaken beliefs about what we "know" to be true can we avoid the modern-day consequences of those limits.

Are You Susceptible to Errors?



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Vocabulary

Dichotic listening

A task in which different audio streams are presented to each ear. Typically, people are asked to monitor one stream while ignoring the other.

Inattentional blindness

The failure to notice a fully visible, but unexpected, object or event when attention is devoted to something else.

Inattentional deafness

The auditory analog of inattentional blindness. People fail to notice an unexpected sound or voice when attention is devoted to other aspects of a scene.

Selective listening

A method for studying selective attention in which people focus attention on one auditory stream of information while deliberately ignoring other auditory information.

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PSYC 100 XI

MEMORY

31. Memory (Encoding, Storage, Retrieval)

Original chapter by Kathleen B. McDermott and Henry L. Roediger III adapted by the Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

“Memory” is a single term that reflects a number of different abilities: holding information briefly while working with it (working memory), remembering episodes of one's life (episodic memory), and our general knowledge of facts of the world (semantic memory), among other types. Remembering episodes involves three processes: encoding information (learning it, by perceiving it and relating it to past knowledge), storing it (maintaining it over time), and then retrieving it (accessing the information when needed). Failures can occur at any stage, leading to forgetting or to having false memories. The key to improving one's memory is to improve processes of encoding and to use techniques that guarantee effective retrieval. Good encoding techniques include relating new information to what one already knows, forming mental images, and creating associations among information that

needs to be remembered. The key to good retrieval is developing effective cues that will lead the rememberer back to the encoded information. Classic mnemonic systems, known since the time of the ancient Greeks and still used by some today, can greatly improve one's memory abilities.

Learning Objectives

- Define and note differences between the following forms of memory: working memory, episodic memory, semantic memory, collective memory.
- Describe the three stages in the process of learning and remembering.
- Describe strategies that can be used to enhance the original learning or encoding of information.
- Describe strategies that can improve the process of retrieval.
- Describe why the classic mnemonic device, the method of loci, works so well.

Introduction

In 2013, Simon Reinhard sat in front of 60 people in a room at Washington University, where he memorized an increasingly long series of digits. On the first round, a computer generated 10 random digits—6 1 9 4 8 5 6 3 7 1—on a screen for 10 seconds. After the series disappeared, Simon typed them into his computer. His recollection was perfect. In the next phase, 20 digits appeared on the screen for 20 seconds. Again, Simon got them all correct. No one in the audience (mostly professors, graduate students, and undergraduate students) could recall the 20 digits perfectly. Then came 30 digits, studied for 30

seconds; once again, Simon didn't misplace even a single digit. For a final trial, 50 digits appeared on the screen for 50 seconds, and again, Simon got them all right. In fact, Simon would have been happy to keep going. His record in this task—called “forward digit span”—is 240 digits!



In some ways memory is like file drawers where you store mental information. Memory is also a series of processes: how does that information get filed to begin with and how does it get retrieved when needed? [Image: M Cruz, <https://goo.gl/DhOMgp>, CC BY-SA 4.0, <https://goo.gl/SWjq94>]

When most of us witness a performance like that of Simon Reinhard, we think one of two things: First, maybe he's cheating somehow. (No, he is not.) Second, Simon must have abilities more advanced than the rest of humankind. After all, psychologists established many years ago that the normal memory span for adults is about 7 digits, with some of us able to recall a few more and others a few less (Miller, 1956). That is why the first phone numbers were limited to 7

digits—psychologists determined that many errors occurred (costing the phone company money) when the number was increased to even 8 digits. But in normal testing, no one gets 50 digits correct in a row, much less 240. So, does Simon Reinhard simply have a photographic memory? He does not. Instead, Simon has taught himself simple strategies for remembering that have greatly increased his capacity for remembering virtually any type of material—digits, words, faces and names, poetry, historical dates, and so on. Twelve years earlier, before he started training his memory abilities, he had a digit span of 7, just like most of us. Simon has been training his abilities for about 10 years as of this writing, and has

risen to be in the top two of “memory athletes.” In 2012, he came in second place in the World Memory Championships (composed of 11 tasks), held in London. He currently ranks second in the world, behind another German competitor, Johannes Mallow. In this module, we reveal what psychologists and others have learned about memory, and we also explain the general principles by which you can improve your own memory for factual material.

Varieties of Memory

For most of us, remembering digits relies on *short-term*

memory, or *working*

memory—the ability to hold information in our minds for a brief time and work with it (e.g., multiplying 24×17 without using paper would rely on working memory).

Another type of memory is **episodic memory**—the ability to remember the episodes of our lives. If you were given the task of recalling everything you did 2 days ago, that would be a test of episodic memory; you would be required to

mentally travel through the day in your mind and note the main events. **Semantic memory** is our storehouse of more-or-less permanent knowledge, such as the meanings of words in a language (e.g., the meaning of “parasol”) and the huge



To be a good chess player you have to learn to increase working memory so you can plan ahead for several offensive moves while simultaneously anticipating – through use of memory – how the other player could counter each of your planned moves. [Image: karpidis, <https://goo.gl/EhzMKM>, CC BY-SA 2.0, <https://goo.gl/jSSrcO>]

collection of facts about the world (e.g., there are 196 countries in the world, and 206 bones in your body). *Collective memory* refers to the kind of memory that people in a group share (whether family, community, schoolmates, or citizens of a state or a country). For example, residents of small towns often strongly identify with those towns, remembering the local customs and historical events in a unique way. That is, the community's collective memory passes stories and recollections between neighbors and to future generations, forming a memory system unto itself.

Psychologists continue to debate the classification of types of memory, as well as which types rely on others (**Tulving, 2007**), but for this module we will focus on episodic memory. Episodic memory is usually what people think of when they hear the word "memory." For example, when people say that an older relative is "losing her memory" due to Alzheimer's disease, the type of memory-loss they are referring to is the inability to recall events, or episodic memory. (Semantic memory is actually preserved in early-stage Alzheimer's disease.) Although remembering specific events that have happened over the course of one's entire life (e.g., your experiences in sixth grade) can be referred to as **autobiographical memory**, we will focus primarily on the episodic memories of more recent events.

Three Stages of the Learning/Memory Process

Psychologists distinguish between three necessary stages in the learning and memory process: **encoding, storage, and retrieval (Melton, 1963)**. Encoding is defined as the initial learning of information; storage refers to maintaining information over time; retrieval is the ability to access

information when you need it. If you meet someone for the first time at a party, you need to encode her name (Lyn Goff) while you associate her name with her face. Then you need to maintain the information over time. If you see her a week later, you need to recognize her face and have it serve as a cue to retrieve her name. Any successful act of remembering requires that all three stages be intact. However, two types of errors can also occur. Forgetting is one type: you see the person you met at the party and you cannot recall her name. The other error is misremembering (false recall or false recognition): you see someone who looks like Lyn Goff and call the person by that name (false recognition of the face). Or, you might see the real Lyn Goff, recognize her face, but then call her by the name of another woman you met at the party (misrecall of her name).

Whenever forgetting or misremembering occurs, we can ask, at which stage in the learning/memory process was there a failure?—though it is often difficult to answer this question with precision. One reason for this inaccuracy is that the three stages are not as discrete as our description implies. Rather, all three stages depend on one another. How we encode information determines how it will be stored and what cues will be effective when we try to retrieve it. And too, the act of retrieval itself also changes the way information is subsequently remembered, usually aiding later recall of the retrieved information. The central point for now is that the three stages—encoding, storage, and retrieval—affect one another, and are inextricably bound together.

Encoding

Encoding refers to the initial experience of perceiving and learning information. Psychologists often study recall by having participants study a list of pictures or words. Encoding in these situations is fairly straightforward. However, “real life” encoding

is much more challenging. When you walk across campus, for example, you encounter countless sights and sounds—friends passing by, people playing Frisbee, music in the air. The physical and mental environments are much too rich for you to encode all the happenings around you or the internal thoughts you have in response to them. So, an important first principle of encoding is that it is selective: we attend to some events in our environment and we ignore others. A second point about encoding is that it is prolific; we are always encoding the events of our lives—attending to the world, trying to understand it. Normally this presents no problem, as our days are filled with routine occurrences, so we don't need to pay attention to everything. But if something does happen that seems strange—during your daily walk across campus, you see a giraffe—then we pay close attention and try to understand why we are seeing what we are seeing.

Right after your typical walk across campus (one without the appearance of a giraffe), you would be able to remember the events reasonably well if you were asked. You could say whom you bumped into, what song was playing from a radio, and so on. However, suppose someone asked you to recall the same walk a month later. You wouldn't stand a chance. You would likely be able to recount the basics of a typical walk across campus, but not the precise details of that particular walk. Yet, if you had seen a giraffe during that



A giraffe in the context of a zoo or its natural habitat may register as nothing more than ordinary, but put it in another setting – in the middle of a campus or a busy city – and its level of distinctiveness increases dramatically.

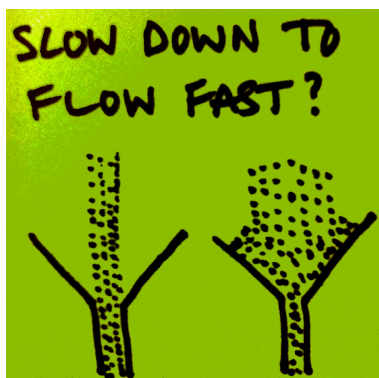
Distinctiveness is a key attribute to remembering events. [Image: Colin J Babb, <https://goo.gl/Cci2yl>, CC BY-SA 2.0, <https://goo.gl/jSSrcO>]

walk, the event would have been fixed in your mind for a long time, probably for the rest of your life. You would tell your friends about it, and, on later occasions when you saw a giraffe, you might be reminded of the day you saw one on campus. Psychologists have long pinpointed **distinctiveness**—having an event stand out as quite different from a background of similar events—as a key to remembering events (Hunt, 2003).

In addition, when vivid memories are tinged with strong emotional content, they often seem to leave a permanent mark on us. Public tragedies, such as terrorist attacks, often create vivid memories in those who witnessed them. But even those of us not directly involved in such events may have vivid memories of them, including memories of first hearing about them. For example, many people are able to recall their exact physical location when they first learned about the assassination or accidental death of a national figure. The term **flashbulb memory** was originally coined by Brown and Kulik (1977) to describe this sort of vivid memory of finding out an important piece of news. The name refers to how some memories seem to be captured in the mind like a flash photograph; because of the distinctiveness and emotionality of the news, they seem to become permanently etched in the mind with exceptional clarity compared to other memories.

Take a moment and think back on your own life. Is there a particular memory that seems sharper than others? A memory where you can recall unusual details, like the colors of mundane things around you, or the exact positions of surrounding objects? Although people have great confidence in flashbulb memories like these, the truth is, our objective accuracy with them is far from perfect (Talarico & Rubin, 2003). That is, even though people may have great confidence in what they recall, their memories are not as accurate (e.g., what the actual colors were; where objects were truly placed) as they tend to imagine. Nonetheless, all other things being equal, distinctive and emotional events are well-remembered.

Details do not leap perfectly from the world into a person's mind. We might say that we went to a party and remember it, but what we remember is (at best) what we encoded. As noted above, the process of encoding is selective, and in complex situations, relatively few of many possible details are noticed and encoded. The process of encoding always involves **recoding**—that is, taking the information from the form it is delivered to us and then converting it in a way that we can make sense of it. For example, you might try to remember the colors of a rainbow by using the acronym ROY G BIV (red, orange, yellow, green, blue, indigo, violet). The process of recoding the colors into a name can help us to remember. However, recoding can also introduce errors—when we accidentally add information during encoding, then remember that *new* material as if it had been part of the actual experience (as discussed below).



Although it requires more effort, using images and associations can improve the process of recoding. [Image: psd, <https://goo.gl/9xjcDe>, CC BY 2.0, <https://goo.gl/9uSnqN>]

Psychologists have studied many recoding strategies that can be used during study to improve retention. First, research advises that, as we study, we should think of the meaning of the events (**Craik & Lockhart, 1972**), and we should try to relate new events to information we already know. This helps us form associations that we can use to retrieve information later. Second, imagining events also makes them more memorable;

creating vivid images out of information (even verbal information) can greatly improve later recall (**Bower & Reitman, 1972**). Creating imagery is part of the technique

Simon Reinhard uses to remember huge numbers of digits, but we can all use images to encode information more effectively. The basic concept behind good encoding strategies is to form distinctive memories (ones that stand out), and to form links or associations among memories to help later retrieval (**Hunt & McDaniel, 1993**). Using study strategies such as the ones described here is challenging, but the effort is well worth the benefits of enhanced learning and retention.

We emphasized earlier that encoding is selective: people cannot encode all information they are exposed to. However, recoding can add information that was not even seen or heard during the initial encoding phase. Several of the recoding processes, like forming associations between memories, can happen without our awareness. This is one reason people can sometimes remember events that did not actually happen—because during the process of recoding, details got added. One common way of inducing false memories in the laboratory employs a word-list technique (**Deese, 1959; Roediger & McDermott, 1995**). Participants hear lists of 15 words, like *door, glass, pane, shade, ledge, sill, house, open, curtain, frame, view, breeze, sash, screen, and shutter*. Later, participants are given a test in which they are shown a list of words and asked to pick out the ones they'd heard earlier. This second list contains some words from the first list (e.g., *door, pane, frame*) and some words not from the list (e.g., *arm, phone, bottle*). In this example, one of the words on the test is *window*, which—importantly—does not appear in the first list, but which is related to other words in that list. When subjects were tested, they were reasonably accurate with the studied words (*door*, etc.), recognizing them 72% of the time. However, when *window* was on the test, they falsely recognized it as having been on the list 84% of the time (**Stadler, Roediger, & McDermott, 1999**). The same thing happened with many other lists the authors used. This phenomenon is referred to as the DRM (for Deese-Roediger-

McDermott) effect. One explanation for such results is that, while students listened to items in the list, the words triggered the students to think about *window*, even though *window* was never presented. In this way, people seem to encode events that are not actually part of their experience.

Because humans are creative, we are always going beyond the information we are given: we automatically make associations and infer from them what is happening. But, as with the word association mix-up above, sometimes we make false memories from our inferences—remembering the inferences themselves as if they were actual experiences. To illustrate this, Brewer (1977) gave people sentences to remember that were designed to elicit *pragmatic inferences*. Inferences, in general, refer to instances when something is not explicitly stated, but we are still able to guess the undisclosed intention. For example, if your friend told you that she didn't want to go out to eat, you may infer that she doesn't have the money to go out, or that she's too tired. With *pragmatic inferences*, there is usually *one* particular inference you're likely to make. Consider the statement Brewer (1977) gave her participants: "The karate champion hit the cinder block." After hearing or seeing this sentence, participants who were given a memory test tended to remember the statement as having been, "The karate champion *broke* the cinder block." This remembered statement is not necessarily a *logical* inference (i.e., it is perfectly reasonable that a karate champion could hit a cinder block without breaking it). Nevertheless, the *pragmatic* conclusion from hearing such a sentence is that the block was likely broken. The participants remembered this inference they made while hearing the sentence in place of the actual words that were in the sentence (see also **McDermott & Chan, 2006**).

Encoding—the initial registration of information—is essential in the learning and memory process. Unless an event is

encoded in some fashion, it will not be successfully remembered later. However, just because an event is encoded (even if it is encoded well), there's no guarantee that it will be remembered later.

Storage

Every experience we have changes our brains. That may seem like a bold, even strange, claim at first, but it's true. We encode each of our experiences within the structures of the nervous system, making new impressions in the process—and each of those impressions involves changes in the brain. Psychologists (and neurobiologists) say that experiences leave **memory**



Memory traces, or engrams, are NOT perfectly preserved recordings of past experiences. The traces are combined with current knowledge to reconstruct what we think happened in the past. [Simon Bierdwal, <https://goo.gl/JDhdCE>, CC BY-NC-SA 2.0, <https://goo.gl/jSSrcO>]

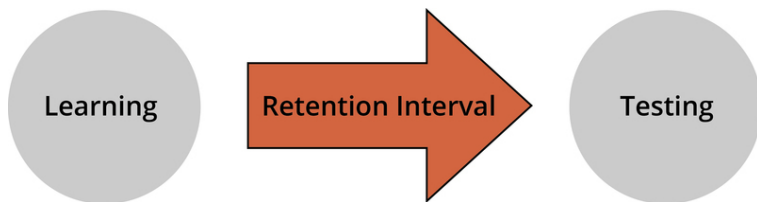
traces, or engrams (the two terms are synonyms). Memories have to be stored somewhere in the brain, so in order to do so, the brain biochemically alters itself and its neural tissue. Just like you might write yourself a note to remind you of something, the brain “writes” a memory trace, changing its own physical composition to do so. The basic idea is that events (occurrences in our environment) create engrams through a process of **consolidation**: the neural changes that occur after learning to create the memory trace of an experience. Although neurobiologists are concerned with exactly what neural processes change when memories are created, for psychologists, the term *memory trace* simply refers

to the physical change in the nervous system (whatever that may be, exactly) that represents our experience.

Although the concept of engram or memory trace is extremely useful, we shouldn't take the term too literally. It is important to understand that memory traces are not perfect little packets of information that lie dormant in the brain, waiting to be called forward to give an accurate report of past experience. Memory traces are not like video or audio recordings, capturing experience with great accuracy; as discussed earlier, we often have errors in our memory, which would not exist if memory traces were perfect packets of information. Thus, it is wrong to think that remembering involves simply "reading out" a faithful record of past experience. Rather, when we remember past events, we reconstruct them with the aid of our memory traces—but also with our current belief of what happened. For example, if you were trying to recall for the police who started a fight at a bar, you may not have a memory trace of who pushed whom first. However, let's say you remember that one of the guys held the door open for you. When thinking back to the start of the fight, this knowledge (of how one guy was friendly to you) may unconsciously influence your memory of what happened in favor of the nice guy. Thus, memory is a construction of what you actually recall and what you believe happened. In a phrase, remembering is reconstructive (we reconstruct our past with the aid of memory traces) not reproductive (a perfect reproduction or recreation of the past).

Psychologists refer to the time between learning and testing as the retention interval. Memories can consolidate during that time, aiding retention. However, experiences can also occur that undermine the memory. For example, think of what you had for lunch yesterday—a pretty easy task. However, if you had to recall what you had for lunch 17 days ago, you may well fail (assuming you don't eat the same thing every day). The 16 lunches you've had since that one have created **retroactive**

interference. Retroactive interference refers to new activities (i.e., the subsequent lunches) during the retention interval (i.e., the time between the lunch 17 days ago and now) that interfere with retrieving the specific, older memory (i.e., the lunch details from 17 days ago). But just as newer things can interfere with remembering older things, so can the opposite happen. *Proactive interference* is when past memories interfere with the encoding of new ones. For example, if you have ever studied a second language, often times the grammar and vocabulary of your native language will pop into your head, impairing your fluency in the foreign language.



Retroactive interference is one of the main causes of forgetting (**McGeoch, 1932**). In the module *Eyewitness Testimony and Memory Biases* Elizabeth Loftus describes her fascinating work on eyewitness memory, in which she shows how memory for an event can be changed via misinformation supplied during the retention interval. For example, if you witnessed a car crash but subsequently heard people describing it from their own perspective, this new information may interfere with or disrupt your own personal recollection of the crash. In fact, you may even come to remember the event happening exactly as the others described it! This **misinformation effect** in eyewitness memory represents a type of retroactive interference that can occur during the retention interval (see Loftus **2005** for a review). Of course, if correct information is given during the retention interval, the witness's memory will usually be improved.

Although interference may arise between the occurrence of an event and the attempt to recall it, *the effect itself is always expressed when we retrieve memories*, the topic to which we turn next.

Retrieval

Endel Tulving argued that “the key process in memory is retrieval” (1991, p. 91). Why should retrieval be given more prominence than encoding or storage? For one thing, if information were encoded and stored but could not be retrieved, it would be useless. As discussed previously in this module, we encode and store thousands of events—conversations, sights and sounds—every day, creating memory traces. However, we later access only a tiny portion of what we’ve taken in. Most of our memories will never be used—in the sense of being brought back to mind, consciously. This fact seems so obvious that we rarely reflect on it. All those events that happened to you in the fourth grade that seemed so important then? Now, many years later, you would struggle to remember even a few. You may wonder if the traces of those memories still exist in some latent form. Unfortunately, with currently available methods, it is impossible to know.

Psychologists distinguish information that is available in memory from that which is accessible (**Tulving & Pearlstone, 1966**). *Available* information is the information that is stored in memory—but precisely how much and what types are stored cannot be known. That is, all we can know is what information we can retrieve—*accessible* information. The assumption is that accessible information represents only a tiny slice of the information available in our brains. Most of us have had the experience of trying to remember some fact or event, giving up, and then—all of a sudden!—it comes to us at a later time, even after we’ve stopped trying to remember it. Similarly, we all

know the experience of failing to recall a fact, but then, if we are given several choices (as in a multiple-choice test), we are easily able to recognize it.



We can't know the entirety of what is in our memory, but only that portion we can actually retrieve. Something that cannot be retrieved now and which is seemingly gone from memory may, with different cues applied, reemerge. [Image: Ores2k, <https://goo.gl/1du8Qe>, CC BY-NC-SA 2.0, <https://goo.gl/jSSrcO>]

What factors determine what information can be retrieved from memory? One critical factor is the type of hints, or *cues*, in the environment. You may hear a song on the radio that suddenly evokes memories of an earlier time in your life, even if you were not trying to remember it when the song came on. Nevertheless, the song is closely associated with that time, so it brings the experience to mind.

The general principle that underlies the effectiveness of retrieval cues is the **encoding**

specificity principle (Tulving & Thomson, 1973): when people encode information, they do so in specific ways. For example, take the song on the radio: perhaps you heard it while you were at a terrific party, having a great, philosophical conversation with a friend. Thus, the song became part of that whole complex experience. Years later, even though you haven't thought about that party in ages, when you hear the song on the radio, the whole experience rushes back to you. In general, the encoding specificity principle states that, to the extent a retrieval cue (the song) matches or overlaps the memory trace of an experience (the party, the conversation), it will be effective in evoking the memory. A classic experiment on the encoding specificity principle had participants memorize a set of words in a unique setting. Later, the participants were tested on the

word sets, either in the same location they learned the words or a different one. As a result of encoding specificity, the students who took the test in the same place they learned the words were actually able to recall more words (**Godden & Baddeley, 1975**) than the students who took the test in a new setting.

One caution with this principle, though, is that, for the cue to work, it can't match too many other experiences (**Nairne, 2002; Watkins, 1975**). Consider a lab experiment. Suppose you study 100 items; 99 are words, and one is a picture—of a penguin, item 50 in the list. Afterwards, the cue “recall the picture” would evoke “penguin” perfectly. No one would miss it. However, if the *word* “penguin” were placed in the same spot among the other 99 words, its memorability would be exceptionally worse. This outcome shows the power of distinctiveness that we discussed in the section on encoding: one picture is perfectly recalled from among 99 words because it stands out. Now consider what would happen if the experiment were repeated, but there were 25 pictures distributed within the 100-item list. Although the picture of the penguin would still be there, the probability that the cue “recall the picture” (at item 50) would be useful for the penguin would drop correspondingly. Watkins (**1975**) referred to this outcome as demonstrating the **cue overload principle**. That is, to be effective, a retrieval cue cannot be overloaded with too many memories. For the cue “recall the picture” to be effective, it should only match one item in the target set (as in the one-picture, 99-word case).

To sum up how memory cues function: for a retrieval cue to be effective, a match must exist between the cue and the desired target memory; furthermore, to produce the best retrieval, the cue-target relationship should be distinctive. Next, we will see how the encoding specificity principle can work in practice.

Psychologists measure memory performance by using production tests (involving recall) or recognition tests

(involving the selection of correct from incorrect information, e.g., a multiple-choice test). For example, with our list of 100 words, one group of people might be asked to recall the list in any order (a free recall test), while a different group might be asked to circle the 100 studied words out of a mix with another 100, unstudied words (a recognition test). In this situation, the recognition test would likely produce better performance from participants than the recall test.

We usually think of recognition tests as being quite easy, because the cue for retrieval is a copy of the actual event that was presented for study. After all, what could be a better cue than the exact target (memory) the person is trying to access? In most cases, this line of reasoning is true; nevertheless, recognition tests do not provide perfect indexes of what is stored in memory. That is, you can fail to recognize a target staring you right in the face, yet be able to recall it later with a different set of cues (**Watkins & Tulving, 1975**). For example, suppose you had the task of recognizing the surnames of famous authors. At first, you might think that being given the actual last name would always be the best cue. However, research has shown this not necessarily to be true (**Muter, 1984**). When given names such as Tolstoy, Shaw, Shakespeare, and Lee, subjects might well say that Tolstoy and Shakespeare are famous authors, whereas Shaw and Lee are not. But, when given a cued recall test using first names, people often recall items (produce them) that they had failed to recognize before. For example, in this instance, a cue like *George Bernard _____* often leads to a recall of “Shaw,” even though people initially failed to recognize *Shaw* as a famous author’s name. Yet, when given the cue “William,” people may not come up with Shakespeare, because William is a common name that matches many people (the cue overload principle at work). This strange fact—that recall can sometimes lead to better performance than recognition—can be explained by the encoding specificity principle. As a cue, *George*

Bernard _____ matches the way the famous writer is stored in memory better than does his surname, *Shaw*, does (even though it is the target). Further, the match is quite distinctive with *George Bernard* _____, but the cue *William* _____ is much more overloaded (Prince William, William Yeats, William Faulkner, will.i.am).

The phenomenon we have been describing is called the *recognition failure of recallable words*, which highlights the point that a cue will be most effective depending on how the information has been encoded (**Tulving & Thomson, 1973**). The point is, the cues that work best to evoke retrieval are those that recreate the event or name to be remembered, whereas sometimes even the target itself, such as *Shaw* in the above example, is not the best cue. Which cue will be most effective depends on how the information has been encoded.

Whenever we think about our past, we engage in the act of retrieval. We usually think that retrieval is an objective act because we tend to imagine that retrieving a memory is like pulling a book from a shelf, and after we are done with it, we return the book to the shelf just as it was. However, research shows this assumption to be false; far from being a static repository of data, the memory is constantly changing. In fact, every time we retrieve a memory, it is altered. For example, the act of retrieval itself (of a fact, concept, or event) makes the retrieved memory much more likely to be retrieved again, a phenomenon called the *testing effect* or the *retrieval practice effect* (**Pyc & Rawson, 2009; Roediger & Karpicke, 2006**). However, retrieving some information can actually cause us to forget other information related to it, a phenomenon called *retrieval-induced forgetting* (**Anderson, Bjork, & Bjork, 1994**). Thus the act of retrieval can be a double-edged sword—strengthening the memory just retrieved (usually by a large amount) but harming related information (though this effect is often relatively small).

As discussed earlier, retrieval of distant memories is

reconstructive. We weave the concrete bits and pieces of events in with assumptions and preferences to form a coherent story (**Bartlett, 1932**). For example, if during your 10th birthday, your dog got to your cake before you did, you would likely tell that story for years afterward. Say, then, in later years you misremember where the dog actually found the cake, but repeat that error over and over during subsequent retellings of the story. Over time, that inaccuracy would become a basic fact of the event in your mind. Just as retrieval practice (repetition) enhances accurate memories, so will it strengthen errors or false memories (**McDermott, 2006**). Sometimes memories can even be manufactured just from hearing a vivid story. Consider the following episode, recounted by Jean Piaget, the famous developmental psychologist, from his childhood:

One of my first memories would date, if it were true, from my second year. I can still see, most clearly, the following scene, in which I believed until I was about 15. I was sitting in my pram . . . when a man tried to kidnap me. I was held in by the strap fastened round me while my nurse bravely tried to stand between me and the thief. She received various scratches, and I can still vaguely see those on her face. . . . When I was about 15, my parents received a letter from my former nurse saying that she had been converted to the Salvation Army. She wanted to confess her past faults, and in particular to return the watch she had been given as a reward on this occasion. She had made up the whole story, faking the scratches. I therefore must have heard, as a child, this story, which my parents believed, and projected it into the past in the form of a visual memory. . . . Many real memories are doubtless of the same order. (**Norman & Schacter, 1997**, pp. 187–188)

Piaget's vivid account represents a case of a pure reconstructive memory. He heard the tale told repeatedly, and

doubtless told it (and thought about it) himself. The repeated telling cemented the events as though they had really happened, just as we are all open to the possibility of having “many real memories ... of the same order.” The fact that one can remember precise details (the location, the scratches) does not necessarily indicate that the memory is true, a point that has been confirmed in laboratory studies, too (e.g., **Norman & Schacter, 1997**).

Putting It All Together: Improving Your Memory

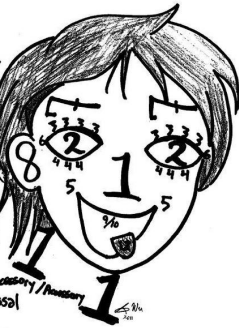
A central theme of this module has been the importance of the encoding and retrieval processes, and their interaction. To recap: to improve learning and memory, we need to encode information in conjunction with excellent cues that will bring back the remembered events when we need them. But how do we do this? Keep in mind the two critical principles we have discussed: to maximize retrieval, we should construct *meaningful* cues that remind us of the original experience, and those cues should be *distinctive* and *not associated with other memories*. These two conditions are critical in maximizing cue effectiveness (**Nairne, 2002**).

So, how can these principles be adapted for use in many situations? Let's go back to how we started the module, with Simon Reinhard's ability to memorize huge numbers of digits. Although it was not obvious, he applied these same general memory principles, but in a more deliberate way. In fact, all **mnemonic devices**, or memory aids/tricks, rely on these fundamental principles. In a typical case, the person learns a set of cues and then applies these cues to learn and remember information. Consider the set of 20 items below that are easy to learn and remember (**Bower & Reitman, 1972**).

1. is a gun. 11 is penny-one, hot dog bun.
2. is a shoe. 12 is penny-two, airplane glue.
3. is a tree. 13 is penny-three, bumble bee.
4. is a door. 14 is penny-four, grocery store.
5. is knives. 15 is penny-five, big beehive.
6. is sticks. 16 is penny-six, magic tricks.
7. is oven. 17 is penny-seven, go to heaven.
8. is plate. 18 is penny-eight, golden gate.
9. is wine. 19 is penny-nine, ball of twine.
10. is hen. 20 is penny-ten, ballpoint pen.

It would probably take you less than 10 minutes to learn this list and practice recalling it several times (remember to use retrieval practice!). If you were to do so, you would have a set of peg words on which you could “hang” memories. In fact, this mnemonic device is called the *peg word technique*. If you then needed to remember some discrete items—say a grocery list, or points you wanted to make in a speech—this method would let you do so in a very precise yet flexible way. Suppose you had to remember bread, peanut butter, bananas, lettuce, and so on. The way to use the method is to form a vivid image of what you want to remember and imagine it interacting with your peg words (as many as you need). For example, for these items, you might imagine a large gun (the first peg word) shooting a loaf of bread, then a jar of peanut butter inside a shoe, then large bunches of bananas hanging from a tree, then a door slamming on a head of lettuce with leaves flying everywhere. The idea is to provide good, distinctive cues (the weirder the better!) for the information you need to remember while you are learning it. If you do this, then retrieving it later is relatively easy. You know your cues perfectly (one is gun, etc.), so you simply go through your cue word list and “look” in your mind’s eye at the image stored there (bread, in this case).

1. Olfactory
2. Optic
3. Oculomotor
4. Trochlear
5. Trigeminal
6. Abducens
7. Facial
8. Vestibulo Cochlear
9. Glossopharyngeal
10. Vagus
11. Spinal accessory / accessory
12. Hypoglossal



On Old Olympus' Towering Top, A

Finn And German Viewed Some Hops

Example of a mnemonic system created by a student to study cranial nerves. [Image: Kelidimari, <https://goo.gl/kiAtkP>, CC BY-SA 3.0, <https://goo.gl/SCKRfm>]

This peg word method may sound strange at first, but it works quite well, even with little training (Roediger, 1980). One word of warning, though, is that the items to be remembered need to be presented relatively slowly at first, until you have practice associating each with its cue word. People get faster with time. Another interesting aspect of this technique is that it's just as easy to recall the items in backwards order as forwards. This is because the peg words provide direct

access to the memorized items, regardless of order.

How did Simon Reinhard remember those digits? Essentially he has a much more complex system based on these same principles. In his case, he uses “memory palaces” (elaborate scenes with discrete places) combined with huge sets of images for digits. For example, imagine mentally walking through the home where you grew up and identifying as many distinct areas and objects as possible. Simon has hundreds of such memory palaces that he uses. Next, for remembering digits, he has memorized a set of 10,000 images. Every four-digit number for him immediately brings forth a mental image. So, for example, 6187 might recall Michael Jackson. When Simon hears all the numbers coming at him, he places an image for every four digits into locations in his memory palace. He can do this at an incredibly rapid rate, faster than 4 digits per 4 seconds when they are flashed visually, as in the demonstration at the beginning of the module. As noted, his record is 240 digits, recalled in exact order. Simon also holds

the world record in an event called “speed cards,” which involves memorizing the precise order of a shuffled deck of cards. Simon was able to do this in 21.19 seconds! Again, he uses his memory palaces, and he encodes groups of cards as single images.

Many books exist on how to improve memory using mnemonic devices, but all involve forming distinctive encoding operations and then having an infallible set of memory cues. We should add that to develop and use these memory systems beyond the basic peg system outlined above takes a great amount of time and concentration. The World Memory Championships are held every year and the records keep improving. However, for most common purposes, just keep in mind that to remember well you need to encode information in a distinctive way and to have good cues for retrieval. You can adapt a system that will meet most any purpose.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Autobiographical memory

Memory for the events of one's life.

Consolidation

The process occurring after encoding that is believed to stabilize memory traces.

Cue overload principle

The principle stating that the more memories that are associated to a particular retrieval cue, the less effective the cue will be in prompting retrieval of any one memory.

Distinctiveness

The principle that unusual events (in a context of similar events) will be recalled and recognized better than uniform (nondistinctive) events.

Encoding

The initial experience of perceiving and learning events.

Encoding specificity principle

The hypothesis that a retrieval cue will be effective to the extent that information encoded from the cue overlaps or matches information in the engram or memory trace.

Engrams

A term indicating the change in the nervous system representing an event; also, memory trace.

Episodic memory

Memory for events in a particular time and place.

Flashbulb memory

Vivid personal memories of receiving the news of some momentous (and usually emotional) event.

Memory traces

A term indicating the change in the nervous system representing an event.

Misinformation effect

When erroneous information occurring after an event is remembered as having been part of the original event.

Mnemonic devices

A strategy for remembering large amounts of information, usually involving imaging events occurring on a journey or with some other set of memorized cues.

Recoding

The ubiquitous process during learning of taking information in one form and converting it to another form, usually one more easily remembered.

Retrieval

The process of accessing stored information.

Retroactive interference

The phenomenon whereby events that occur after some particular event of interest will usually cause forgetting of the original event.

Semantic memory

The more or less permanent store of knowledge that people have.

Storage

The stage in the learning/memory process that bridges encoding and retrieval; the persistence of memory over time.

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32. Forgetting and Amnesia

Original chapter by Nicole Dudukovic and Brice Kuhl adapted by the Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

This module explores the causes of everyday forgetting and considers pathological forgetting in the context of amnesia. Forgetting is viewed as an adaptive process that allows us to be efficient in terms of the information we retain.

Learning Objectives

- Identify five reasons we forget and give examples of each.
- Describe how forgetting can be viewed as an adaptive process.
- Explain the difference between anterograde and retrograde amnesia.

Introduction

Chances are that you have experienced memory lapses and been frustrated by them. You may have had trouble remembering the definition of a key term on an exam or found yourself unable to recall the name of an actor from one of your favorite TV shows. Maybe you forgot to call your aunt on her birthday or you routinely forget where you put your cell phone. Oftentimes, the bit of information we are searching for comes back to us, but sometimes it does not. Clearly, forgetting seems to be a natural part of life. Why do we forget? And is forgetting always a bad thing?



Forgetting can often be obnoxious or even embarrassing. But as we explore this module, you'll learn that forgetting is important and necessary for everyday functionality. [Image: jazbeck, <https://goo.gl/nkRrJy>, CC BY 2.0, <https://goo.gl/BRvSA7>]

Causes of Forgetting

One very common and obvious reason why you cannot

remember a piece of information is because you did not learn it in the first place. If you fail to encode information into memory, you are not going to remember it later on. Usually, **encoding** failures occur because we are distracted or are not paying attention to specific details. For example, people have a lot of trouble recognizing an actual penny out of a set of drawings of very similar pennies, or lures, even though most of us have had a lifetime of experience handling pennies (**Nickerson & Adams, 1979**). However, few of us have studied the features of a penny in great detail, and since we have not attended to those details, we fail to recognize them later. Similarly, it has been well documented that distraction during learning impairs later memory (e.g., **Craik, Govoni, Naveh-Benjamin, & Anderson, 1996**). Most of the time this is not problematic, but in certain situations, such as when you are studying for an exam, failures to encode due to distraction can have serious repercussions.

Another proposed reason why we forget is that memories fade, or **decay**, over time. It has been known since the pioneering work of Hermann Ebbinghaus (**1885/1913**) that as time passes, memories get harder to recall. Ebbinghaus created more than 2,000 nonsense syllables, such as *dax*, *bap*, and *rif*, and studied his own memory for them, learning as many as 420 lists of 16 nonsense syllables for one experiment. He found that his memories diminished as time passed, with the most forgetting happening early on after learning. His observations and subsequent research suggested that if we do not rehearse a memory and the neural representation of that memory is not reactivated over a long period of time, the memory representation may disappear entirely or fade to the point where it can no longer be accessed. As you might imagine, it is hard to definitively prove that a memory has decayed as opposed to it being inaccessible for another reason. Critics argued that forgetting must be due to processes other than simply the passage of time, since disuse of a memory

does not always guarantee forgetting (**McGeoch, 1932**). More recently, some memory theorists have proposed that recent memory traces may be degraded or disrupted by new experiences (**Wixted, 2004**). Memory traces need to be **consolidated**, or transferred from the hippocampus to more durable representations in the cortex, in order for them to last (**McGaugh, 2000**). When the consolidation process is interrupted by the encoding of other experiences, the memory trace for the original experience does not get fully developed and thus is forgotten.



At times, we will completely blank on something we're certain we've learned – people we went to school with years ago for example. However, once we get the right retrieval cue (a name perhaps), the memory (faces or experiences) rushes back to us like it was there all along. [Image: sbhsclass84, <https://goo.gl/sHZyQI>, CC BY-SA 2.0, <https://goo.gl/rxiUsF>]

Both encoding failures and decay account for more permanent forms of forgetting, in which the memory trace does not exist, but forgetting may also occur when a memory exists yet we temporarily cannot access it. This type of forgetting may occur when we lack the appropriate **retrieval** cues for bringing the memory to mind. You have probably had the frustrating experience of forgetting your password for an online site. Usually, the password has not been permanently forgotten; instead, you just need the

right reminder to remember what it is. For example, if your password was “pizza0525,” and you received the password hints “favorite food” and “Mom’s birthday,” you would easily be able to retrieve it. Retrieval hints can bring back to mind seemingly forgotten memories (**Tulving & Pearlstone, 1966**). One real-life illustration of the importance of retrieval cues comes from a

study showing that whereas people have difficulty recalling the names of high school classmates years after graduation, they are easily able to recognize the names and match them to the appropriate faces (**Bahrnick, Bahrnick, & Wittinger, 1975**). The names are powerful enough retrieval cues that they bring back the memories of the faces that went with them. The fact that the presence of the right retrieval cues is critical for remembering adds to the difficulty in proving that a memory is permanently forgotten as opposed to temporarily unavailable.

Retrieval failures can also occur because other memories are blocking or getting in the way of recalling the desired memory. This blocking is referred to as **interference**. For example, you may fail to remember the name of a town you visited with your family on summer vacation because the names of other towns you visited on that trip or on other trips come to mind instead. Those memories then prevent the desired memory from being retrieved. Interference is also relevant to the example of forgetting a password: passwords that we have used for other websites may come to mind and interfere with our ability to retrieve the desired password. Interference can be either proactive, in which old memories block the learning of new related memories, or retroactive, in which new memories block the retrieval of old related memories. For both types of interference, competition between memories seems to be key (**Mensink & Raaijmakers, 1988**). Your memory for a town you visited on vacation is unlikely to interfere with your ability to remember an Internet password, but it is likely to interfere with your ability to remember a different town's name. Competition between memories can also lead to forgetting in a different way. Recalling a desired memory in the face of competition may result in the inhibition of related, competing memories (**Levy & Anderson, 2002**). You may have difficulty recalling the name of Kennebunkport, Maine, because other Maine towns, such as Bar Harbor, Winterport, and Camden, come to mind instead. However, if you are able to recall Kennebunkport

despite strong competition from the other towns, this may actually change the competitive landscape, weakening memory for those other towns' names, leading to forgetting of them instead.

Box 1. Five Impediments to Remembering

1. Encoding failures - we don't learn the information in the first place
2. Decay - memories fade over time
3. Inadequate retrieval cues - we lack sufficient reminders
4. Interference - other memories get in the way
5. Trying not to remember - we deliberately attempt to keep things out of mind

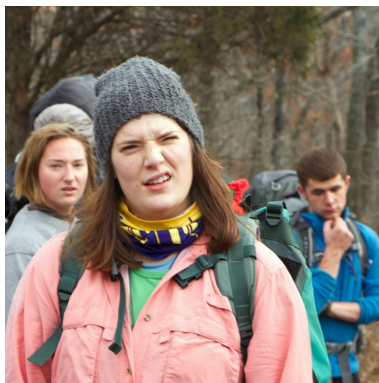
(Hertel & Calcaterra, 2005).

Finally, some memories may be forgotten because we *deliberately attempt to keep them out of mind*. Over time, by actively trying not to remember an event, we can sometimes successfully keep the undesirable memory from being retrieved either by inhibiting the undesirable memory or generating

diversionary thoughts (**Anderson & Green, 2001**). Imagine that you slipped and fell in your high school cafeteria during lunch time, and everyone at the surrounding tables laughed at you. You would likely wish to avoid thinking about that event and might try to prevent it from coming to mind. One way that you could accomplish this is by thinking of other, more positive, events that are associated with the cafeteria. Eventually, this memory may be suppressed to the point that it would only be retrieved with great difficulty

Adaptive Forgetting

We have explored five different causes of forgetting. Together they can account for the day-to-day episodes of forgetting that each of us experience. Typically, we think of these episodes in a negative light and view forgetting as a memory failure. Is forgetting ever good? Most people would reason that forgetting that occurs in response to a deliberate attempt to keep an event out of mind is a good thing. No one wants to be constantly reminded of falling on their face in front of

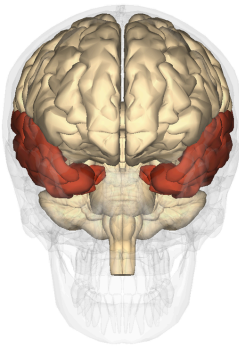


Could you imagine being unable to forget every path you have taken while hiking? Each new trip, you would be walking around the forest for days, incapable of distinguishing today's path from the prior ones. [Image: Dan Trew, <https://goo.gl/8fJWWE>, CC BY-SA 2.0, <https://goo.gl/rxiUsF>]

all of their friends. However, beyond that, it can be argued that forgetting is adaptive, allowing us to be efficient and hold onto only the most relevant memories (**Bjork, 1989; Anderson & Milson, 1989**). Shereshevsky, or “S,” the mnemonist studied by Alexander Luria (**1968**), was a man who almost never forgot. His memory appeared to be virtually limitless. He could memorize a table of 50 numbers in under 3 minutes and recall the numbers in rows, columns, or diagonals with ease. He could recall lists of words and passages that he had memorized over a decade before. Yet Shereshevsky found it difficult to function in his everyday life because he was constantly distracted by a flood of details and associations that sprung to mind. His case history suggests that remembering everything is not always a good thing. You may occasionally have trouble remembering where you parked your car, but imagine if every time you had

to find your car, every single former parking space came to mind. The task would become impossibly difficult to sort through all of those irrelevant memories. Thus, forgetting is adaptive in that it makes us more efficient. The price of that efficiency is those moments when our memories seem to fail us (Schacter, 1999).

Amnesia



Patients with damage to the temporal lobes may experience anterograde amnesia and/or retrograde amnesia. [Image: en:Anatomography, <https://goo.gl/ALPAu6>, CC BY-SA 2.1 JP, <https://goo.gl/BDF2Z4>]

Clearly, remembering everything would be maladaptive, but what would it be like to remember nothing? We will now consider a profound form of forgetting called amnesia that is distinct from more ordinary forms of forgetting. Most of us have had exposure to the concept of amnesia through popular movies and television. Typically, in these fictionalized portrayals of amnesia, a character suffers some type of blow to the head and suddenly has no

idea who they are and can no longer recognize their family or remember any events from their past. After some period of time (or another blow to the head), their memories come flooding back to them. Unfortunately, this portrayal of amnesia is not very accurate. What does amnesia typically look like?

The most widely studied amnesic patient was known by his initials H. M. (Scoville & Milner, 1957). As a teenager, H. M. suffered from severe epilepsy, and in 1953, he underwent

surgery to have both of his medial temporal lobes removed to relieve his epileptic seizures. The **medial temporal lobes** encompass the hippocampus and surrounding cortical tissue. Although the surgery was successful in reducing H. M.'s seizures and his general intelligence was preserved, the surgery left H. M. with a profound and permanent memory deficit. From the time of his surgery until his death in 2008, H. M. was unable to learn new information, a memory impairment called **anterograde amnesia**. H. M. could not remember any event that occurred since his surgery, including highly significant ones, such as the death of his father. He could not remember a conversation he had a few minutes prior or recognize the face of someone who had visited him that same day. He could keep information in his short-term, or working, memory, but when his attention turned to something else, that information was lost for good. It is important to note that H. M.'s memory impairment was restricted to **declarative memory**, or conscious memory for facts and events. H. M. could learn new motor skills and showed improvement on motor tasks even in the absence of any memory for having performed the task before (**Corkin, 2002**).

In addition to anterograde amnesia, H. M. also suffered from **temporally graded retrograde amnesia**. **Retrograde amnesia** refers to an inability to retrieve old memories that occurred before the onset of amnesia. Extensive retrograde amnesia in the absence of anterograde amnesia is very rare (**Kopelman, 2000**). More commonly, retrograde amnesia co-occurs with anterograde amnesia and shows a temporal gradient, in which memories closest in time to the onset of amnesia are lost, but more remote memories are retained (**Hodges, 1994**). In the case of H. M., he could remember events from his childhood, but he could not remember events that occurred a few years before the surgery.

Amnesiac patients with damage to the hippocampus and surrounding medial temporal lobes typically manifest a similar

clinical profile as H. M. The degree of anterograde amnesia and retrograde amnesia depend on the extent of the medial temporal lobe damage, with greater damage associated with a more extensive impairment (**Reed & Squire, 1998**). Anterograde amnesia provides evidence for the role of the hippocampus in the formation of long-lasting declarative memories, as damage to the hippocampus results in an inability to create this type of new memory. Similarly, temporally graded retrograde amnesia can be seen as providing further evidence for the importance of memory consolidation (**Squire & Alvarez, 1995**). A memory depends on the hippocampus until it is consolidated and transferred into a more durable form that is stored in the cortex. According to this theory, an amnesiac patient like H. M. could remember events from his remote past because those memories were fully consolidated and no longer depended on the hippocampus.

Dr. Brenda Milner, one of the psychological scientists who worked with H.M., is a pioneering expert in the field of Neuropsychology. Indeed, she is often referred to as a founder of the field of clinical neuropsychology and cognitive neuroscience. She is a Distinguished Professor in the Department of Neurology and Neurosurgery at McGill University. You can learn more about her work here: <https://www.mcgill.ca/neuro/about/brenda-milner>. In the below video clip, Dr. Milner talks about her work with H.M.



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view them online here:

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The classic amnesiac syndrome we have considered here is sometimes referred to as organic amnesia, and it is distinct from functional, or dissociative, amnesia. Functional amnesia involves a loss of memory that cannot be attributed to brain injury or any obvious brain disease and is typically classified as a mental disorder rather than a neurological disorder (Kihlstrom, 2005). The clinical profile of dissociative amnesia is very different from that of patients who suffer from amnesia due to brain damage or deterioration. Individuals who experience **dissociative amnesia** often have a history of trauma. Their amnesia is retrograde, encompassing autobiographical memories from a portion of their past. In an extreme version of this disorder, people enter a dissociative fugue state, in which they lose most or all of their autobiographical memories and their sense of personal identity. They may be found wandering in a new location, unaware of who they are and how they got there. Dissociative amnesia is controversial, as both the causes and existence of it have been called into question. The memory loss associated with dissociative amnesia is much less likely to be permanent than it is in organic amnesia.

Conclusion

Just as the case study of the mnemonist Shereshevsky illustrates what a life with a near perfect memory would be like, amnesiac patients show us what a life without memory would be like. Each of the mechanisms we discussed that explain everyday forgetting—encoding failures, decay, insufficient retrieval cues, interference, and intentional attempts to forget—help to keep us highly efficient, retaining the important information and for the most part, forgetting the unimportant. Amnesiac patients allow us a glimpse into what life would be like if we suffered from profound forgetting and

perhaps show us that our everyday lapses in memory are not so bad after all.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Anterograde amnesia

Inability to form new memories for facts and events after the onset of amnesia.

Consolidation

Process by which a memory trace is stabilized and transformed into a more durable form.

Decay

The fading of memories with the passage of time.

Declarative memory

Conscious memories for facts and events.

Dissociative amnesia

Loss of autobiographical memories from a period in the past in the absence of brain injury or disease.

Encoding

Process by which information gets into memory.

Interference

Other memories get in the way of retrieving a desired memory

Medial temporal lobes

Inner region of the temporal lobes that includes the hippocampus.

Retrieval

Process by which information is accessed from memory and utilized.

Retrograde amnesia

Inability to retrieve memories for facts and events acquired before the onset of amnesia.

Temporally graded retrograde amnesia

Inability to retrieve memories from just prior to the onset of amnesia with intact memory for more remote events.

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33. Eyewitness Testimony and Memory Biases

Original chapter by Cara Laney and
Elizabeth F. Loftus adapted by the Queen's
University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link:

<https://sass.queensu.ca/psyc100/>

Eyewitnesses can provide very compelling legal testimony, but rather than recording experiences flawlessly, their memories are susceptible to a variety of errors and biases. They (like the rest of us) can make errors in remembering specific details and can even remember whole events that did not actually happen. In this module, we discuss several of the common types of errors, and what they can tell us about human memory and its interactions with the legal system.

Learning Objectives

- Describe the kinds of mistakes that eyewitnesses commonly make and some of the ways that this can

impede justice.

- Explain some of the errors that are common in human memory.
- Describe some of the important research that has demonstrated human memory errors and their consequences.

What Is Eyewitness Testimony?

Eyewitness testimony is what happens when a person witnesses a crime (or accident, or other legally important event) and later gets up on the stand and recalls for the court all the details of the witnessed event. It involves a more complicated process than might initially be presumed. It includes what happens during the actual crime to facilitate or hamper witnessing, as well as everything that happens from the time the event is over to the later courtroom appearance. The eyewitness may be interviewed by the police and numerous lawyers, describe the perpetrator to several different people, and make an identification of the perpetrator, among other things.



What can happen to our memory from the time we witness an event to the retelling of that event later? What can influence how we remember, or misremember, highly significant events like a crime or accident? [Image: Robert Couse-Baker, <https://goo.gl/OiPUmz>, CC BY 2.0, <https://goo.gl/BRvSA7>]

Why Is Eyewitness Testimony an Important Area of Psychological Research?

When an eyewitness stands up in front of the court and describes what happened from her own perspective, this testimony can be extremely compelling—it is hard for those hearing this testimony to take it “with a grain of salt,” or otherwise adjust its power. But to what extent is this necessary?

There is now a wealth of evidence, from research conducted over several decades, suggesting that eyewitness testimony is probably the most persuasive form of evidence presented in court, but in many cases, its accuracy is dubious. There is also evidence that mistaken eyewitness evidence can lead to

wrongful conviction—sending people to prison for years or decades, even to death row, for crimes they did not commit. Faulty eyewitness testimony has been implicated in at least 75% of DNA exoneration cases—more than any other cause (**Garrett, 2011**). In a particularly famous case, a man named Ronald Cotton was identified by a rape victim, Jennifer Thompson, as her rapist, and was found guilty and sentenced to life in prison. After more than 10 years, he was exonerated (and the real rapist identified) based on DNA evidence. For details on this case and other (relatively) lucky individuals whose false convictions were subsequently overturned with DNA evidence, see the Innocence Project website (<http://www.innocenceproject.org/>).

There is also hope, though, that many of the errors may be avoidable if proper precautions are taken during the investigative and judicial processes. Psychological science has taught us what some of those precautions might involve, and we discuss some of that science now.

Misinformation



Misinformation can be introduced into the memory of a witness between the time of seeing an event and reporting it later. Something as straightforward as which sort of traffic sign was in place at an intersection can be confused if subjects are exposed to erroneous information after the initial incident.

In an early study of eyewitness memory, undergraduate subjects first watched a slideshow depicting a small red car driving and then hitting a pedestrian (Loftus, Miller, & Burns, 1978). Some subjects were then asked leading questions about what had happened in the slides. For example, subjects were asked, "How fast was the car traveling when it passed the yield sign?" But this question was actually designed to be misleading, because the original slide included a stop sign rather than a yield sign.

Later, subjects were shown pairs of slides. One of the pair was the original slide containing the stop sign; the other was a replacement slide containing a yield sign. Subjects were asked which of the pair they had previously seen. Subjects who had been asked about the yield sign were likely to pick the slide showing the yield sign, even though they had originally seen the slide with the stop sign. In other words, the misinformation in the leading question led to inaccurate memory.

This phenomenon is called the **misinformation effect**,

because the misinformation that subjects were exposed to after the event (here in the form of a misleading question) apparently contaminates subjects' memories of what they witnessed. Hundreds of subsequent studies have demonstrated that memory can be contaminated by erroneous information that people are exposed to after they witness an event (see **Frenda, Nichols, & Loftus, 2011; Loftus, 2005**). The misinformation in these studies has led people to incorrectly remember everything from small but crucial details of a perpetrator's appearance to objects as large as a barn that wasn't there at all.

These studies have demonstrated that young adults (the typical research subjects in psychology) are often susceptible to misinformation, but that children and older adults can be even more susceptible (**Bartlett & Memon, 2007; Ceci & Bruck, 1995**). In addition, misinformation effects can occur easily, and without any intention to deceive (**Allan & Gabbert, 2008**). Even slight differences in the wording of a question can lead to misinformation effects. Subjects in one study were more likely to say yes when asked "Did you see the broken headlight?" than when asked "Did you see a broken headlight?" (**Loftus, 1975**).

Other studies have shown that misinformation can corrupt memory even more easily when it is encountered in social situations (**Gabbert, Memon, Allan, & Wright, 2004**). This is a problem particularly in cases where more than one person witnesses a crime. In these cases, witnesses tend to talk to one another in the immediate aftermath of the crime, including as they wait for police to arrive. But because different witnesses are different people with different perspectives, they are likely to see or notice different things, and thus remember different things, even when they witness the same event. So when they communicate about the crime later, they not only reinforce common memories for the event, they also contaminate each other's memories for the event (**Gabbert, Memon, & Allan,**

2003; Paterson & Kemp, 2006; Takarangi, Parker, & Garry, 2006).

The misinformation effect has been modeled in the laboratory. Researchers had subjects watch a video in pairs. Both subjects sat in front of the same screen, but because they wore differently polarized glasses, they saw two different versions of a video, projected onto a screen. So, although they were both watching the same screen, and believed (quite reasonably) that they were watching the same video, they were actually watching two different versions of the video (**Garry, French, Kinzett, & Mori, 2008**).

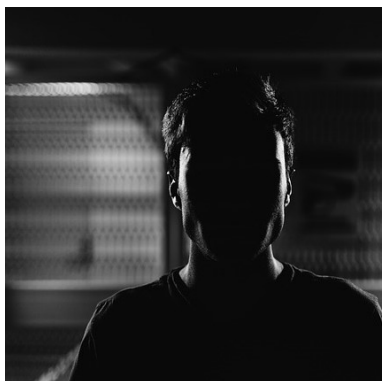
In the video, Eric the electrician is seen wandering through an unoccupied house and helping himself to the contents thereof. A total of eight details were different between the two videos. After watching the videos, the “co-witnesses” worked together on 12 memory test questions. Four of these questions dealt with details that were different in the two versions of the video, so subjects had the chance to influence one another. Then subjects worked individually on 20 additional memory test questions. Eight of these were for details that were different in the two videos. Subjects’ accuracy was highly dependent on whether they had discussed the details previously. Their accuracy for items they had *not* previously discussed with their co-witness was 79%. But for items that they *had* discussed, their accuracy dropped markedly, to 34%. That is, subjects allowed their co-witnesses to corrupt their memories for what they had seen.

Identifying Perpetrators

In addition to correctly remembering many details of the crimes they witness, eyewitnesses often need to remember the faces and other identifying features of the perpetrators of those crimes. Eyewitnesses are often asked to describe that

perpetrator to law enforcement and later to make identifications from books of mug shots or lineups. Here, too, there is a substantial body of research demonstrating that eyewitnesses can make serious, but often understandable and even predictable, errors (Caputo & Dunning, 2005; Cutler & Penrod, 1995).

In most jurisdictions in the United States, lineups are typically conducted with pictures, called **photo spreads**, rather than with actual people standing behind one-way glass (Wells, Memon, & Penrod, 2006). The eyewitness is given a set of small pictures of perhaps six or eight individuals who are dressed similarly and photographed in similar circumstances. One of these individuals is the police suspect, and the remainder are “**foils**” or “**fillers**” (people known to be innocent of the particular crime under investigation). If the eyewitness identifies the suspect, then the investigation of that suspect is likely to progress. If a witness identifies a foil or no one, then the police may choose to move their investigation in another direction.



Mistakes in identifying perpetrators can be influenced by a number of factors including poor viewing conditions, too little time to view the perpetrator, or too much delay from time of witnessing to identification.

This process is modeled in laboratory studies of eyewitness identifications. In these studies, research subjects witness a mock crime (often as a short video) and then are asked to make an identification from a photo or a live lineup. Sometimes the lineups are target present, meaning that the perpetrator from the mock crime is actually in the lineup, and sometimes they are target absent, meaning that the lineup is made up entirely of foils. The subjects,

or **mock witnesses**, are given some instructions and asked to pick the perpetrator out of the lineup. The particular details of the witnessing experience, the instructions, and the lineup members can all influence the extent to which the mock witness is likely to pick the perpetrator out of the lineup, or indeed to make any selection at all. Mock witnesses (and indeed real witnesses) can make errors in two different ways. They can fail to pick the perpetrator out of a target present lineup (by picking a foil or by neglecting to make a selection), or they can pick a foil in a target absent lineup (wherein the only correct choice is to not make a selection).

Some factors have been shown to make eyewitness identification errors particularly likely. These include poor vision or viewing conditions during the crime, particularly stressful witnessing experiences, too little time to view the perpetrator or perpetrators, too much delay between witnessing and identifying, and being asked to identify a perpetrator from a race other than one's own (Bornstein, Deffenbacher, Penrod, & McGorty, **2012**; Brigham, Bennett, Meissner, & Mitchell, **2007**; Burton, Wilson, Cowan, & Bruce, 1999; Deffenbacher, Bornstein, Penrod, & McGorty, **2004**).

It is hard for the legal system to do much about most of these problems. But there are some things that the justice system can do to help lineup identifications “go right.” For example, investigators can put together high-quality, fair lineups. A fair lineup is one in which the suspect and each of the foils is equally likely to be chosen by someone who has read an eyewitness description of the perpetrator but who did not actually witness the crime (Brigham, Ready, & Spier, 1990). This means that no one in the lineup should “stick out,” and that everyone should match the description given by the eyewitness. Other important recommendations that have come out of this research include better ways to conduct lineups, “double blind” lineups, unbiased instructions for witnesses, and conducting lineups in a sequential fashion (see

Technical Working Group for Eyewitness Evidence, 1999; Wells et al., 1998; Wells & Olson, 2003).

Kinds of Memory Biases

Memory is also susceptible to a wide variety of other biases and errors. People can forget events that happened to them and people they once knew. They can mix up details across time and place. They can even remember whole complex events that never happened at all. Importantly, these errors, once made, can be very hard to unmake. A memory is no less “memorable” just because it is wrong.

Some small memory errors are commonplace, and you have no doubt experienced many of them. You set down your keys without paying attention, and then cannot find them later when you go to look for them. You try to come up with a person’s name but cannot find it, even though you have the sense that it is right at the tip of your tongue (psychologists actually call this the tip-of-the-tongue effect, or TOT) (Brown, 1991).

Other sorts of memory biases are more complicated and longer lasting. For example, it turns out that our expectations and beliefs about how the world works can have huge influences on our memories. Because many aspects of



For most of our experiences schematas are a benefit and help with information overload. However, they may make it difficult or impossible to recall certain details of a situation later. Do you recall the library as it actually was or the library as approximated by your library schemata? [Dan Kleinman, <https://goo.gl/07xyDD>, CC BY 2.0, <https://goo.gl/BRvSA7>]

our everyday lives are full of redundancies, our memory systems take advantage of the recurring patterns by forming and using **schemata**, or memory templates (Alba & Hasher, 1983; Brewer & Treyens, 1981). Thus, we know to expect that a library will have shelves and tables and librarians, and so we don't have to spend energy noticing these at the time. The result of this lack of attention, however, is that one is likely to remember schema-consistent information (such as tables), and to remember them in a rather generic way, whether or not they were actually present.

False Memory

Some memory errors are so “large” that they almost belong in a class of their own: **false memories**. Back in the early 1990s a pattern emerged whereby people would go into therapy for depression and other everyday problems, but over the course of the therapy develop memories for violent and horrible victimhood (Loftus & Ketcham, 1994). These patients' therapists claimed that the patients were recovering genuine memories of real childhood abuse, buried deep in their minds for years or even decades. But some experimental psychologists believed that the memories were instead likely to be false—created in therapy. These researchers then set out to see whether it would indeed be possible for wholly false memories to be created by procedures similar to those used in these patients' therapy.

In early false memory studies, undergraduate subjects' family members were recruited to provide events from the students' lives. The student subjects were told that the researchers had talked to their family members and learned about four different events from their childhoods. The researchers asked if the now undergraduate students remembered each of these four events—introduced via short hints. The subjects were

asked to write about each of the four events in a booklet and then were interviewed two separate times. The trick was that one of the events came from the researchers rather than the family (and the family had actually assured the researchers that this event had *not* happened to the subject). In the first such study, this researcher-introduced event was a story about being lost in a shopping mall and rescued by an older adult. In this study, after just being asked whether they remembered these events occurring on three separate occasions, a quarter of subjects came to believe that they had indeed been lost in the mall (**Loftus & Pickrell, 1995**). In subsequent studies, similar procedures were used to get subjects to believe that they nearly drowned and had been rescued by a lifeguard, or that they had spilled punch on the bride's parents at a family wedding, or that they had been attacked by a vicious animal as a child, among other events (Heaps & Nash, **1999**; Hyman, Husband, & Billings, **1995**; Porter, Yuille, & Lehman, **1999**).

More recent false memory studies have used a variety of different manipulations to produce false memories in substantial minorities and even occasional majorities of manipulated subjects (Braun, Ellis, & Loftus, **2002**; Lindsay, Hagen, Read, Wade, & Garry, **2004**; Mazzoni, Loftus, Seitz, & Lynn, **1999**; Seamon, Philbin, & Harrison, **2006**; Wade, Garry, Read, & Lindsay, **2002**). For example, one group of researchers used a mock-advertising study, wherein subjects were asked to review (fake) advertisements for Disney vacations, to convince subjects that they had once met the character Bugs Bunny at Disneyland—an impossible false memory because Bugs is a Warner Brothers character (**Braun et al., 2002**). Another group of researchers photoshopped childhood photographs of their subjects into a hot air balloon picture and then asked the subjects to try to remember and describe their hot air balloon experience (**Wade et al., 2002**). Other researchers gave subjects unmanipulated class photographs from their childhoods along with a fake story about a class prank, and thus enhanced the

likelihood that subjects would falsely remember the prank (**Lindsay et al., 2004**).

Using a false feedback manipulation, we have been able to persuade subjects to falsely remember having a variety of childhood experiences. In these studies, subjects are told (falsely) that a powerful computer system has analyzed questionnaires that they completed previously and has concluded that they had a particular experience years earlier. Subjects apparently believe what the computer says about them and adjust their memories to match this new information. A variety of different false memories have been implanted in this way. In some studies, subjects are told they once got sick on a particular food (**Bernstein, Laney, Morris, & Loftus, 2005**). These memories can then spill out into other aspects of subjects' lives, such that they often become less interested in eating that food in the future (**Bernstein & Loftus, 2009b**). Other false memories implanted with this methodology include having an unpleasant experience with the character Pluto at Disneyland and witnessing physical violence between one's parents (Berkowitz, Laney, Morris, Garry, & Loftus, **2008**; **Laney & Loftus, 2008**).

Importantly, once these false memories are implanted—whether through complex methods or simple ones—it is extremely difficult to tell them apart from true memories (**Bernstein & Loftus, 2009a**; **Laney & Loftus, 2008**).

Dr. Elizabeth Loftus in Her Own Words

Dr. Loftus is recognized around the world for her work in false memory. In this video, she gives a very brief overview of her work, and she notes the controversy that surrounds her work. This video is not intended to replace the details found in this chapter. Rather, it is intended to give you additional insights into Dr. Loftus' work.



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Conclusion

To conclude, eyewitness testimony is very powerful and convincing to jurors, even though it is not particularly reliable. Identification errors occur, and these errors can lead to people being falsely accused and even convicted. Likewise, eyewitness memory can be corrupted by leading questions, misinterpretations of events, conversations with co-witnesses, and their own expectations for what should have happened. People can even come to remember whole events that never occurred.

The problems with memory in the legal system are real. But what can we do to start to fix them? A number of specific recommendations have already been made, and many of these are in the process of being implemented (e.g., **Stebly & Loftus, 2012**; Technical Working Group for Eyewitness Evidence, **1999**; **Wells et al., 1998**). Some of these recommendations are aimed at specific legal procedures, including when and how witnesses should be interviewed, and how lineups should be constructed and conducted. Other recommendations call for appropriate education (often in the form of expert witness testimony) to be provided to jury members and others tasked with assessing eyewitness memory. Eyewitness testimony can be of great value to the legal system, but decades of research

now argues that this testimony is often given far more weight than its accuracy justifies.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

False memories

Memory for an event that never actually occurred, implanted by experimental manipulation or other means.

Foils

Any member of a lineup (whether live or photograph) other than the suspect.

Misinformation effect

A memory error caused by exposure to incorrect information between the original event (e.g., a crime) and later memory test (e.g., an interview, lineup, or day in court).

Mock witnesses

A research subject who plays the part of a witness in a study.

Photo spreads

A selection of normally small photographs of faces given to a witness for the purpose of identifying a perpetrator.

Schema (plural: schemata)

A memory template, created through repeated exposure to a particular class of objects or events.

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PSYC 100 XII

LANGUAGE, LANGUAGE USE, AND DEVELOPMENT

34. Language and Language Use

Original chapter by Yoshi Kashima adapted by the Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

Humans have the capacity to use complex language, far more than any other species on Earth. We cooperate with each other to use language for communication; language is often used to communicate about and even construct and maintain our social world. Language use and human sociality are inseparable parts of *Homo sapiens* as a biological species.

Learning Objectives

- Define basic terms used to describe language use.
- Describe the process by which people can share new information by using language.
- Characterize the typical content of conversation and its social implications.
- Characterize psychological consequences of language use

and give an example.

Introduction

Imagine two men of 30-something age, Adam and Ben, walking down the corridor. Judging from their clothing, they are young businessmen, taking a break from work. They then have this exchange.

Adam: "You know, Gary bought a ring."

Ben: "Oh yeah? For Mary, isn't it?" (Adam nods.)

If you are watching this scene and hearing their conversation, what can you guess from this? First of all, you'd guess that Gary bought a ring for Mary, whoever Gary and Mary might be. Perhaps you would infer that Gary is getting married to Mary. What else can you guess? Perhaps that Adam and Ben are fairly close colleagues, and both of them know Gary and Mary reasonably well. In other words, you can guess the social relationships surrounding the people who are engaging in the conversation and the people whom they are talking about.

Language is used in our everyday lives. If psychology is a science of behavior, scientific investigation of language *use* must be one of the most central topics—this is because language use is ubiquitous. Every human group has a language; human infants (except those who have unfortunate disabilities) learn at least one language without being taught explicitly. Even when children who don't have much language to begin with are brought together,



Language is an essential tool that enables us to live the kind of lives we do. Much of contemporary human civilization wouldn't have been possible without it. [Image: Marc Wathieu, <https://goo.gl/jNSzTC>, CC BY-NC 2.0, <https://goo.gl/VnKIK8>]

they can begin to develop and use their own language. There is at least one known instance where children who had had little language were brought together and developed their own language spontaneously with minimum input from adults. In Nicaragua in the 1980s, deaf children who were separately raised in various locations were brought together to schools for the first time. Teachers tried to teach them Spanish with little success. However, they began to notice that the children were using their hands and gestures, apparently to communicate with each other. Linguists were brought in to find out what was happening—it turned out the children had developed their own sign language by themselves. That was the birth of a new language, Nicaraguan Sign Language (**Kegl, Senghas, & Coppola, 1999**). Language is ubiquitous, and we humans are born to use it.

How Do We Use Language?

If language is so ubiquitous, how do we actually use it? To be sure, some of us use it to write diaries and poetry, but the primary form of language use is interpersonal. That's how we learn language, and that's how we use it. Just like Adam and Ben, we exchange words and utterances to communicate with each other. Let's consider the simplest case of two people, Adam and Ben, talking with each other. According to Clark (1996), in order for them to carry out a conversation, they must keep track of **common ground**. Common ground is a set of knowledge that the speaker and listener share and they think, assume, or otherwise take for granted that they share. So, when Adam says, "Gary bought a ring," he takes for granted that Ben knows the meaning of the words he is using, whom Gary is, and what buying a ring means. When Ben says, "For Mary, isn't it?" he takes for granted that Adam knows the meaning of these words, who Mary is, and what buying a ring for someone means. All these are part of their common ground.



The “common ground” in a conversation helps people coordinate their language use. And as conversations progress common ground shifts and changes as the participants add new information and cooperate to help one another understand.
 [Image: Converse College, <https://goo.gl/UhbMQH>, CC BY-NC 2.0, <https://goo.gl/VnKlK8>]

Note that, when Adam presents the information about Gary’s purchase of a ring, Ben responds by presenting his inference about who the recipient of the ring might be, namely, Mary. In conversational terms, Ben’s utterance acts as evidence for his comprehension of Adam’s utterance—“Yes, I understood that Gary bought a ring”—and Adam’s nod acts as evidence that he now has understood what Ben has said too—“Yes, I understood that you understood that Gary has bought a ring for

Mary.” This new information is now added to the initial common ground. Thus, the pair of utterances by Adam and Ben (called an adjacency pair) together with Adam’s affirmative nod jointly completes one proposition, “Gary bought a ring for Mary,” and adds this information to their common ground. This way, common ground changes as we talk, gathering new information that we agree on and have evidence that we share. It evolves as people take turns to assume the roles of speaker and listener, and actively engage in the exchange of meaning.

Common ground helps people coordinate their language use. For instance, when a speaker says something to a listener, he or she takes into account their common ground, that is, what the speaker thinks the listener knows. Adam said what he did because he knew Ben would know who Gary was. He’d have said, “A friend of mine is getting married,” to another

colleague who wouldn't know Gary. This is called **audience design** (Fussell & Krauss, 1992); speakers design their utterances for their audiences by taking into account the audiences' knowledge. If their audiences are seen to be knowledgeable about an object (such as Ben about Gary), they tend to use a brief label of the object (i.e., Gary); for a less knowledgeable audience, they use more descriptive words (e.g., "a friend of mine") to help the audience understand their utterances (Box 1).

So, language use is a cooperative activity, but how do we coordinate our language use in a conversational setting? To be sure, we have a conversation in small groups. The number of people engaging in a conversation at a time is rarely more than four. By some counts (e.g., Dunbar, Duncan, & Nettle, 1995; James, 1953), more than 90

Box 1. Coordinating Language Use by Audience Design

In systematic research on audience design, Fussell and Krauss (1992) found that, when communicating about public figures, speakers included more descriptive information (e.g., physical appearances, occupation) about lesser known and less identifiable people (e.g., Kevin Kline, Carl Lcahn) than better known ones (e.g., Woody Allen, Clint Eastwood), so that their listeners can identify whom they are talking about. Likewise, Isaacs and Clark (1987) showed that people who were familiar with New York City could gauge their audience's familiarity with NYC soon after they began conversation and adjusted their descriptions of NYC landmarks to help the audience identify such landmarks as the Brooklyn Bridge and Yankee Stadium more easily. More generally, Grice (1975) suggested that speakers often follow certain rules, which he calls conversational maxims, by trying to be informative (maxim of quantity), truthful (maxim of quality), relevant (maxim of relation), and clear and unambiguous (maxim of manner).

percent of conversations happen in a group of four individuals or less. Certainly, coordinating conversation among four is not as difficult as coordinating conversation among 10. But, even among only four people, if you think about it, everyday conversation is an almost miraculous achievement. We typically have a conversation by rapidly exchanging words and utterances in real time in a noisy environment. Think about your conversation at home in the morning, at a bus stop, in a shopping mall. How can we keep track of our common ground under such circumstances?

Pickering and Garrod (2004) argue that we achieve our conversational coordination by virtue of our ability to interactively align each other's actions at different levels of

language use: **lexicon** (i.e., words and expressions), **syntax** (i.e., grammatical rules for arranging words and expressions together), as well as speech rate and accent. For instance, when one person uses a certain expression to refer to an object in a conversation, others tend to use the same expression (e.g., **Clark & Wilkes-Gibbs, 1986**). Furthermore, if someone says “the cowboy offered a banana to the robber,” rather than “the cowboy offered the robber a banana,” others are more likely to use the same syntactic structure (e.g., “the girl gave a book to the boy” rather than “the girl gave the boy a book”) even if different words are involved (**Branigan, Pickering, & Cleland, 2000**). Finally, people in conversation tend to exhibit similar accents and rates of speech, and they are often associated with people’s social identity (**Giles, Coupland, & Coupland, 1991**). So, if you have lived in different places where people have somewhat different accents (e.g., United States and United Kingdom), you might have noticed that you speak with Americans with an American accent, but speak with Britons with a British accent.

Pickering and Garrod (**2004**) suggest that these interpersonal alignments at different levels of language use can activate similar **situation models** in the minds of those who are engaged in a conversation. Situation models are representations about the topic of a conversation. So, if you are talking about Gary and Mary with your friends, you might have a situation model of Gary giving Mary a ring in your mind. Pickering and Garrod’s theory is that as you describe this situation using language, others in the conversation begin to use similar words and grammar, and many other aspects of language use converge. As you all do so, similar situation models begin to be built in everyone’s mind through the mechanism known as **priming**. Priming occurs when your thinking about one concept (e.g., “ring”) reminds you about other related concepts (e.g., “marriage”, “wedding ceremony”). So, if everyone in the conversation knows about Gary, Mary,

and the usual course of events associated with a ring—engagement, wedding, marriage, etc.—everyone is likely to construct a shared situation model about Gary and Mary. Thus, making use of our highly developed interpersonal ability to imitate (i.e., executing the same action as another person) and cognitive ability to infer (i.e., one idea leading to other ideas), we humans coordinate our common ground, share situation models, and communicate with each other.

What Do We Talk About?

What are humans doing when we are talking? Surely, we can communicate about mundane things such as what to have for dinner, but also more complex and abstract things such as the meaning of life and death, liberty, equality, and fraternity, and many other philosophical thoughts. Well, when naturally occurring conversations were actually observed (Dunbar, Marriott, & Duncan, 1997), a staggering 60%–70% of everyday conversation, for both men and women, turned out to be



Studies show that people love to gossip. By gossiping, humans can communicate and share their representations about their social world—who their friends and enemies are, what the right thing to do is under what circumstances, and so on. [Image: aqua.mech, <https://goo.gl/Q7Ap4b>, CC BY 2.0, <https://goo.gl/T4qgSp>]

gossip—people talk about themselves and others whom they know. Just like Adam and Ben, more often than not, people use language to communicate about their social world.

Gossip may sound trivial and seem to belittle our noble ability

for language—surely one of the most remarkable human abilities of all that distinguish us from other animals. *Au contraire*, some have argued that gossip—activities to think and communicate about our social world—is one of the most critical uses to which language has been put. Dunbar (1996) conjectured that gossiping is the human equivalent of grooming, monkeys and primates attending and tending to each other by cleaning each other's fur. He argues that it is an act of socializing, signaling the importance of one's partner. Furthermore, by gossiping, humans can communicate and share their representations about their social world—who their friends and enemies are, what the right thing to do is under what circumstances, and so on. In so doing, they can regulate their social world—making more friends and enlarging one's own group (often called the **ingroup**, the group to which one belongs) against other groups (**outgroups**) that are more likely to be one's enemies. Dunbar has argued that it is these social effects that have given humans an evolutionary advantage and larger brains, which, in turn, help humans to think more complex and abstract thoughts and, more important, maintain larger ingroups. Dunbar (1993) estimated an equation that predicts average group size of nonhuman primate genera from their average neocortex size (the part of the brain that supports higher order cognition). In line with his **social brain hypothesis**, Dunbar showed that those primate genera that have larger brains tend to live in larger groups. Furthermore, using the same equation, he was able to estimate the group size that human brains can support, which turned out to be about 150—approximately the size of modern hunter-gatherer communities. Dunbar's argument is that language, brain, and human group living have co-evolved—language and human sociality are inseparable.

Dunbar's hypothesis is controversial. Nonetheless, whether or not he is right, our everyday language use often *ends up* maintaining the existing structure of intergroup

relationships. Language use can have implications for how we construe our social world. For one thing, there are subtle cues that people use to convey the extent to which someone's action is just a special case in a particular context or a pattern that occurs across many contexts and more like a character trait of the person. According to Semin and Fiedler (1988), someone's action can be described by an action verb that describes a concrete action (e.g., he runs), a state verb that describes the actor's psychological state (e.g., he likes running), an adjective that describes the actor's personality (e.g., he is athletic), or a noun that describes the actor's role (e.g., he is an athlete). Depending on whether a verb or an adjective (or noun) is used, speakers can convey the permanency and stability of an actor's tendency to act in a certain way—verbs convey particularity, whereas adjectives convey permanency. Intriguingly, people tend to describe positive actions of their ingroup members using adjectives (e.g., he is generous) rather than verbs (e.g., he gave a blind man some change), and negative actions of outgroup members using adjectives (e.g., he is cruel) rather than verbs (e.g., he kicked a dog). Maass, Salvi, Arcuri, and Semin (1989) called this a **linguistic intergroup bias**, which can produce and reproduce the representation of intergroup relationships by painting a picture favoring the ingroup. That is, ingroup members are typically good, and if they do anything bad, that's more an exception in special circumstances; in contrast, outgroup members are typically bad, and if they do anything good, that's more an exception.

Box 2. Emotion & Talk

People tend to tell stories that evoke strong emotions (Rimé, Mesquita, Philippot, & Boca, 1991). Such emotive stories can then spread far and wide through people's social networks. When a group of 33 psychology students visited a city morgue (no doubt an emotive experience for many), they told their experience to about six people on average; each of these people who heard about it told one person, who in turn told another person on average. By this third retelling of the morgue visit, 881 people had heard about this in their community within 10 days. If everyone in society is connected with one another by six degrees of separation (Travers & Milgram, 1969) and if a chain letter can travel hundreds of steps via the Internet (Liben-Nowell & Klein, 2008), the possibility of emotive gossip traveling through a vast social network is not a fantasy. Indeed, urban legends that evoke strong feelings of disgust tend to spread in cyberspace and become more prevalent on the Internet (Heath, Bell, & Sternberg, 2001).

In addition, when people exchange their gossip, it can spread through broader **social networks**. If gossip is transmitted from one person to another, the second person can transmit it to a third person, who then in turn transmits it to a fourth, and so on through a chain of communication. This often happens for emotive stories (Box 2). If gossip is

repeatedly transmitted and spread, it can reach a large number of people. When stories travel through communication chains, they tend to become conventionalized (**Bartlett, 1932**). A Native American tale of the “War of the Ghosts” recounts a warrior’s encounter with ghosts traveling in canoes and his involvement with their ghostly battle. He is shot by an arrow but doesn’t die, returning home to tell the tale. After his narration, however, he becomes still, a black thing comes out of his mouth, and he eventually dies. When it was told to a student in England in the 1920s and retold from memory to another person, who, in turn, retold it to another and so on in a communication chain, the mythic tale became a story of a young warrior going to a battlefield, in which canoes became boats, and the black thing that came out of his mouth became simply his spirit (**Bartlett, 1932**). In other words, information transmitted multiple times was transformed to something that was easily understood by many, that is, information was assimilated into the common ground shared by most people in the linguistic community. More recently, Kashima (**2000**) conducted a similar experiment using a story that contained a sequence of events that described a young couple’s interaction that included both stereotypical and counter-stereotypical actions (e.g., a man

watching sports on TV on Sunday vs. a man vacuuming the house). After the retelling of this story, much of the counter-stereotypical information was dropped, and stereotypical information was more likely to be retained. Because stereotypes are part of the common ground shared by the community, this finding too suggests that conversational retellings are likely to reproduce conventional content.

Psychological Consequences of Language Use

What are the psychological consequences of language use? When people use language to describe an experience, their thoughts and feelings are profoundly shaped by the linguistic representation that they have produced rather than the original experience per se (**Holtgraves & Kashima, 2008**). For example, Halberstadt (**2003**) showed a picture of a person displaying an ambiguous emotion and examined how people evaluated the displayed emotion. When people verbally explained why the target person was expressing a particular emotion, they tended to remember the person as feeling that emotion more intensely than when they simply labeled the emotion.

Thus, constructing a linguistic representation of another person's emotion apparently biased the speaker's memory of that person's emotion. Furthermore, linguistically labeling one's own emotional experience appears to alter the speaker's neural processes. When people linguistically labeled negative images, the amygdala—a brain structure



By verbalizing our own emotional experiences – such as in a conversation with a close friend – we can improve our psychological well-being. [Image: Drew Herron, <https://goo.gl/IKMAv1>, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

that is critically involved in the processing of negative emotions such as fear—was activated less than when they were not given a chance to label them (**Lieberman et al., 2007**). Potentially because of these effects of verbalizing emotional experiences, linguistic reconstructions of negative life events can have some therapeutic effects on those who suffer from the traumatic experiences (**Pennebaker & Seagal, 1999**). Lyubomirsky, Sousa, and Dickerhoof (**2006**) found that writing and talking about negative past life events improved people's psychological well-being, but just thinking about them worsened it. There are many other examples of effects of language use on memory and decision making (**Holtgraves & Kashima, 2008**).

Box 3. Sapir-Whorf Hypothesis

An example of evidence for Sapir-Whorf hypothesis comes from a comparison between English and Mandarin Chinese speakers (Boroditsky, 2000). In English, time is often metaphorically described in horizontal terms. For instance, good times are ahead of us, or hardship can be left behind us. We can move a meeting forward or backward. Mandarin Chinese speakers use similar horizontal metaphors too, but also use vertical metaphors. So, for instance, the last month is called *shang ge yue* or “above month,” and the next month, *xia ge yue* or “below month.” To put it differently, the arrow of time flies horizontally in English, but it can fly both horizontally and vertically in Chinese. Does this difference in language use affect English and Chinese speakers’ comprehension of language?

This is what Boroditsky (2000) found. First, English and Chinese speakers’ understanding of sentences that use a horizontal (e.g., “June comes before August”) did not differ very much. When they were first presented with a picture that implies a horizontal positioning (e.g., the black worm is ahead of the white worm), they could read and understand them faster than when they were presented with a picture that implies a vertical positioning (e.g., the black ball is above the white ball). This implies that thinking about the horizontal positioning (ahead or behind) equally primed (i.e., reminded) both English and Chinese speakers of the horizontal metaphor used in the sentence about time. However, English and Chinese speakers’ comprehension differed for statements that do not use a spatial metaphor such as “August is later than June.” When primed with the vertical spatial positioning, Chinese speakers comprehended these statements faster, but English speakers more slowly, than when they were primed with the horizontal spatial positioning. Apparently, English speakers were not used to thinking about months in terms of the vertical line, above or below. Indeed, when they were trained to do so, their comprehension was similar to Chinese speakers’ (see Boroditsky, Furman, & McCormick, 2011, for recent review of related research).

Furthermore, if a certain type of language use (linguistic practice) (Holtgraves & Kashima, 2008) is repeated by a large number of people in a community, it can potentially have a significant effect on their thoughts and action. This notion is often called **Sapir-Whorf hypothesis** (Sapir, 1921; Whorf, 1956; Box 3). For instance, if you are given a description of a man, Steven, as having greater than average experience of the world (e.g., well-traveled, varied job experience), a strong family orientation, and well-developed social skills, how do you describe Steven? Do you think you can remember Steven’s personality five days later? It

will probably be difficult. But if you know Chinese and are reading about Steven in Chinese, as Hoffman, Lau, and Johnson (1986) showed, the chances are that you can remember him well. This is because English does not have a word to describe this kind of personality, whereas Chinese does (*shì gù*). This way, the language you use can influence your cognition. In its strong form, it has been argued that language *determines* thought, but this is probably wrong. Language does not completely determine our thoughts—our thoughts are far too flexible for that—but habitual uses of

language can influence our habit of thought and action. For instance, some linguistic practice seems to be associated even with cultural values and social institution. Pronoun drop is the case in point. Pronouns such as “I” and “you” are used to represent the speaker and listener of a speech in English. In an English sentence, these pronouns cannot be dropped if they are used as the subject of a sentence. So, for instance, “I went to the movie last night” is fine, but “Went to the movie last night” is not in standard English. However, in other languages such as Japanese, pronouns can be, and in fact often are, dropped from sentences. It turned out that people living in those countries where pronoun drop languages are spoken tend to have more collectivistic values (e.g., employees having greater loyalty toward their employers) than those who use non-pronoun drop languages such as English (**Kashima & Kashima, 1998**). It was argued that the explicit reference to “you” and “I” may remind speakers the distinction between the self and other, and the differentiation between individuals. Such a linguistic practice may act as a constant reminder of the cultural value, which, in turn, may encourage people to perform the linguistic practice.

Conclusion

Language and language use constitute a central ingredient of human psychology. Language is an essential tool that enables us to live the kind of life we do. Can you imagine a world in which machines are built, farms are cultivated, and goods and services are transported to our household without language? Is it possible for us to make laws and regulations, negotiate contracts, and enforce agreements and settle disputes without talking? Much of contemporary human civilization wouldn't have been possible without the human ability to develop and

use language. Like the Tower of Babel, language can divide humanity, and yet, the core of humanity includes the innate ability for language use. Whether we can use it wisely is a task before us in this globalized world.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Audience design

Constructing utterances to suit the audience's knowledge.

Common ground

Information that is shared by people who engage in a conversation.

Ingroup

Group to which a person belongs.

Lexicon

Words and expressions.

Linguistic intergroup bias

A tendency for people to characterize positive things about their ingroup using more abstract expressions, but negative things about their outgroups using more abstract expressions.

Outgroup

Group to which a person does not belong.

Priming

A stimulus presented to a person reminds him or her about other ideas associated with the stimulus.

Sapir-Whorf hypothesis

The hypothesis that the language that people use determines their thoughts.

Situation model

A mental representation of an event, object, or situation constructed at the time of comprehending a linguistic description.

Social brain hypothesis

The hypothesis that the human brain has evolved, so that humans can maintain larger ingroups.

Social networks

Networks of social relationships among individuals through which information can travel.

Syntax

Rules by which words are strung together to form

sentences.

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35. Theory of Mind

Original chapter by Bertram Malle adapted by the Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

One of the most remarkable human capacities is to perceive and understand mental states. This capacity, often labeled “theory of mind,” consists of an array of psychological processes that play essential roles in human social life. We review some of these roles, examine what happens when the capacity is deficient, and explore the many processes that make up the capacity to understand minds.

Learning Objectives

- Explain what theory of mind is.
- Enumerate the many domains of social life in which theory of mind is critical.
- Describe some characteristics of how individuals diagnosed with autism differ in their processing of others' minds.
- Describe and explain some of the many concepts and processes that comprise the human understanding of

minds.

- Have a basic understanding of how ordinary people explain unintentional and intentional behavior.

Introduction

One of the most fascinating human capacities is the ability to perceive and interpret other people's behavior in terms of their mental states. Having an appreciation for the workings of another person's mind is considered a prerequisite for natural language acquisition (**Baldwin & Tomasello, 1998**), strategic social interaction (**Zhang, Hedden, & Chia, 2012**), reflexive thought (**Bogdan, 2000**), and moral judgment (**Guglielmo, Monroe, & Malle, 2009**). This capacity develops from early beginnings in the first year of life to the adult's fast and often effortless understanding of others' thoughts, feelings, and intentions. And though we must speculate about its evolutionary origin, we do have indications that the capacity evolved sometime in the last few million years.

In this module we will focus on two questions: What is the role of understanding others' minds in human social life? And what is known about the mental processes that underlie such understanding? For simplicity, we will label this understanding **"theory of mind,"** even though it is not literally a "theory" that people have about the mind; rather, it is a capacity that some scholars prefer to label "mentalizing" or "mindreading." But we will go behind all these labels by breaking down the capacity into distinct components: the specific concepts and mental processes that underlie the human understanding of minds.

First, let's get clear about the roles that this understanding plays in social life.

The Role of Theory of Mind in Social Life



We rely on the theory of mind in social situations to infer what others are thinking and feeling. Among other things, this capability helps us work successfully in teams. [Image: Office of Public Affairs, <https://goo.gl/O8zvFj>, CC BY-SA 2.0, <https://goo.gl/rxiUsFj>]

Put yourself in this scene: You observe two people's movements, one behind a large wooden object, the other reaching behind him and then holding a thin object in front of the other. Without a theory of mind you would neither understand what this movement stream meant nor be able to predict either person's likely responses. With the capacity to interpret certain physical movements in terms of mental states, perceivers can parse this complex scene into intentional actions of

reaching and giving (Baird & Baldwin, **2001**); they can interpret the actions as instances of offering and trading; and with an appropriate cultural script, they know that all that was going on was a customer pulling out their credit card with the intention to pay the cashier behind the register. People's theory of mind thus frames and interprets perceptions of human behavior in a particular way—as perceptions of agents who can act intentionally and who have desires, beliefs, and other mental states that guide their actions (**Perner, 1991**; **Wellman, 1990**).

Not only would social perceivers without a theory of mind be utterly lost in a simple payment interaction; without a theory of mind, there would probably be no such things as cashiers, credit cards, and payment (**Tomasello, 2003**). Plain and simple, humans need to understand minds in order to engage in the kinds of complex interactions that social communities (small

and large) require. And it is these complex social interactions that have given rise, in human cultural evolution, to houses, cities, and nations; to books, money, and computers; to education, law, and science.

The list of social interactions that rely deeply on theory of mind is long; here are a few highlights.

- Teaching another person new actions or rules by taking into account what the learner knows or doesn't know and how one might best make him understand.
- Learning the words of a language by monitoring what other people attend to and are trying to do when they use certain words.
- Figuring out our social standing by trying to guess what others think and feel about us.
- Sharing experiences by telling a friend how much we liked a movie or by showing her something beautiful.
- Collaborating on a task by signaling to one another that we share a goal and understand and trust the other's intention to pursue this joint goal.

Autism and Theory of Mind



Individuals with autism can have a harder time using the theory of mind because it involves processing facial expressions and inferring people's intentions. A look that might convey a lot of meaning to most people conveys little or nothing to someone with autism. [Image: WarzauWynn, <https://goo.gl/gUO8HE>, CC BY-NC 2.0, <https://goo.gl/tgFydH>]

Another way of appreciating the enormous impact that theory of mind has on social interactions is to study what happens when the capacity is severely limited, as in the case of autism (Tager-Flusberg, 2007). In a fascinating discussion in which (high-functioning) individuals with autism talk about their difficulties with other people's minds (Blackburn et al., 2000), one person reports: "I know people's faces down to the acne scars on the left corners of their chins . . . and how the hairs of their

eyebrows curl. . . . The best I can do is start picking up bits of data during my encounter with them because there's not much else I can do. . . . I'm not sure what kind of information about them I'm attempting to process." What seems to be missing, as another person with autism remarks, is an "automatic processing of 'people information.'" Some individuals with autism report that they perceive others "in a more analytical way." This analytical mode of processing, however, is very tiresome and slow: "Given time I may be able to analyze someone in various ways, and seem to get good results, but may not pick up on certain aspects of an interaction until I am obsessing over it hours or days later" (Blackburn et al., 2000).

So what is this magical potion that allows most people to

gain quick and automatic access to other people's minds and to recognize the meaning underlying human behavior? Scientific research has accumulated a good deal of knowledge in the past few decades, and here is a synopsis of what we know.

The Mental Processes Underlying Theory of Mind

The first thing to note is that “theory of mind” is not a single thing. What underlies people's capacity to recognize and understand mental states is a whole host of components—a toolbox, as it were, for many different but related tasks in the social world (**Malle, 2008**). Figure 1 shows some of the most important tools, organized in a way that reflects the complexity of involved processes: from simple and automatic on the bottom to complex and deliberate on the top. This organization also reflects development—from tools that infants master within the first 6–12 months to tools they need to acquire over the next 3–5 years. Strikingly, the organization also reflects evolution: monkeys have available the tools on the bottom; chimpanzees have available the tools at the second level; but only humans master the remaining tools above. Let's look at a few of them in more detail.

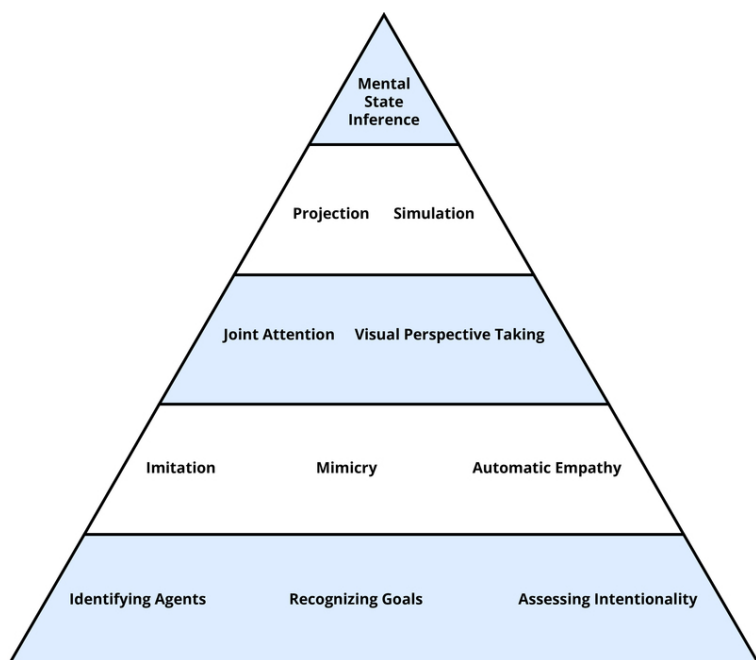


Figure 1. Some of the major tools of theory of mind, with the bottom showing simple, automatic, early developing, and evolutionarily old processes, and the top showing complex, more deliberate, late developing, and evolutionarily recent processes.

Agents, Goals, and Intentionality

The *agent* category allows humans to identify those moving objects in the world that can act on their own. Features that even very young children take to be indicators of being an agent include being self-propelled, having eyes, and reacting systematically to the interaction partner's behavior, such as following gaze or imitating (**Johnson, 2000; Premack, 1990**).

The process of *recognizing goals* builds on this agent category, because agents are characteristically directed toward goal objects, which means they seek out, track, and often

physically contact said objects. Even before the end of their first year, infants recognize that humans reach toward an object they strive for even if that object changes location or if the path to the object contains obstacles (Gergely, Nádasdy, Csibra, & Bíró, 1995; Woodward, 1998). What it means to recognize goals, therefore, is to see the systematic and predictable relationship between a particular agent pursuing a particular object across various circumstances.

Through learning to recognize the many ways by which agents pursue goals, humans learn to pick out behaviors that are **intentional**. The concept of **intentionality** is more sophisticated than the *goal* concept. For one thing, human perceivers recognize that some behaviors can be unintentional even if they were goal-directed—such as when you unintentionally make a fool of yourself even though you had the earnest goal of impressing your date. To act intentionally you need, aside from a goal, the right kinds of beliefs about how to achieve the goal. Moreover, the adult concept of intentionality requires that an agent have the *skill* to perform the intentional action in question: If I am flipping a coin, trying to make it land on heads, and if I get it to land on heads on my first try, you would not judge my action of making it land on heads as intentional—you would say it was luck (Malle & Knobe, 1997).

Imitation, Synchrony, and Empathy



It's natural when having a conversation to unconsciously synchronize with our partners.
[Image: Jacopo Aneghini Photos, <https://goo.gl/QDpPln>, CC BY-NC 2.0, <https://goo.gl/VnKlK8>]

Imitation and empathy are two other basic capacities that aid the understanding of mind from childhood on (Meltzoff & Decety, 2003). Imitation is the human tendency to carefully observe others' behaviors and do as they do—even if it is the first time the perceiver has seen this behavior. A subtle, automatic form of imitation is called **mimicry**, and when people mutually mimic one

another they can reach a state of **synchrony**. Have you ever noticed when two people in conversation take on similar gestures, body positions, even tone of voice? They “synchronize” their behaviors by way of (largely) unconscious imitation. Such synchrony can happen even at very low levels, such as negative physiological arousal (Levenson & Ruef, 1992), though the famous claim of synchrony in women's menstrual cycles is a myth (Yang & Schank, 2006). Interestingly, people who enjoy an interaction synchronize their behaviors more, and increased synchrony (even manipulated in an experiment) makes people enjoy their interaction more (Chartrand & Bargh, 1999). Some research findings suggest that synchronizing is made possible by brain mechanisms that tightly link perceptual information with motor information (when I see you move your arm, my arm-moving program is activated). In monkeys, highly specialized so-called **mirror neurons** fire both when the monkey sees a certain action and when it performs that same action (Rizzolatti, Fogassi, &

Gallese, 2001). In humans, however, things are a bit more complex. In many everyday settings, people perceive uncountable behaviors and fortunately don't copy all of them (just consider walking in a crowd—hundreds of your mirror neurons would fire in a blaze of confusion). Human imitation and mirroring is selective, triggering primarily actions that are relevant to the perceiver's current state or aim.

Automatic empathy builds on imitation and synchrony in a clever way. If Bill is sad and expresses this emotion in his face and body, and if Elena watches or interacts with Bill, then she will subtly imitate his dejected behavior and, through well-practiced associations of certain behaviors and emotions, she will feel a little sad as well (Sonnby-Borgström, Jönsson, & Svensson, **2003**). Thus, she empathizes with him—whether she wants to or not. Try it yourself. Type “sad human faces” into your Internet search engine and select images from your results. Look at 20 photos and pay careful attention to what happens to your face and to your mood. Do you feel almost a “pull” of some of your facial muscles? Do you feel a tinge of melancholy?

Joint Attention, Visual Perspective Taking

Going beyond the automatic, humans are capable of actively engaging with other people's mental states, such as when they enter into situations of **joint attention**—like Marissa and Noah, who are each looking at an object and are both aware that each of them is looking at the object. This sounds more complicated than it really is. Just point to an object when a 3-year old is around and notice how both the child and you check in with each other, ensuring that you are really *jointly* engaging with the object. Such shared engagement is critical for children to learn the meaning of objects—both their value (is it safe and rewarding to approach?) and the words that refer to them (what do you call

this?). When I hold up my keyboard and show it to you, we are jointly attending to it, and if I then say it's called "Tastatur" in German, you know that I am referring to the keyboard and not to the table on which it had been resting.

Another important capacity of engagement is **visual perspective taking**: You are sitting at a dinner table and advise another person on where the salt is—do you consider that it is to *her* left even though it is to *your* right? When we overcome our egocentric perspective this way, we imaginatively adopt the other person's spatial viewpoint and determine how the world looks from their perspective. In fact, there is evidence that we mentally "rotate" toward the other's spatial location, because the farther away the person sits (e.g., 60, 90, or 120 degrees away from you) the longer it takes to adopt the person's perspective (**Michelon & Zacks, 2006**).

Projection, Simulation (and the Specter of Egocentrism)

When imagining what it might be like to be in another person's *psychological* position, humans have to go beyond mental rotation. One tool to understand the other's thoughts or feelings is **simulation**—using one's own mental states as a model for others' mental states: "What would it feel like sitting across from the stern interrogator? I would feel scared . . ." An even simpler form of such modeling is the assumption that the other thinks, feels, wants what we do—which has been called the "like-me" assumption (**Meltzoff, 2007**) or the inclination toward *social projection* (**Krueger, 2007**). In a sense, this is an absence of perspective taking, because we assume that the other's perspective equals our own. This can be an effective strategy if we share with the other person the same environment, background, knowledge, and goals, but it gets us

into trouble when this presumed common ground is in reality lacking. Let's say you know that Brianna doesn't like Fred's new curtains, but you hear her exclaim to Fred, "These are beautiful!" Now you have to predict whether Fred can figure out that Brianna was being sarcastic. It turns out that you will have a hard time suppressing your own knowledge in this case and you may overestimate how easy it is for Fred to spot the sarcasm (**Keysar, 1994**). Similarly, you will overestimate how visible that pimple is on your chin—even though it feels big and ugly to you, in reality very few people will ever notice it (**Gilovich & Savitsky, 1999**). So the next time when you spot a magnificent bird high up in the tree and you get impatient with your friend who just can't see what is clearly obvious, remember: it's obvious to *you*.

What all these examples show is that people use their own current state—of knowledge, concern, or perception—to grasp other people's mental states. And though they often do so correctly, they also get things wrong at times. This is why couples counselors, political advisors, and Buddhists agree on at least one thing: we all need to try harder to recognize our egocentrism and actively take other people's perspective—that is, grasp their actual mental states, even if (or especially when) they are different from our own.

Explicit Mental State Inference

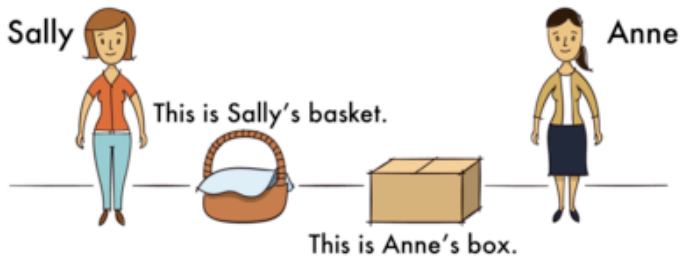
The ability to truly take another person's perspective requires that we separate what we want, feel, and know from what the other person is likely to want, feel, and know. To do so humans make use of a variety of information. For one thing, they rely on stored knowledge—both general knowledge ("Everybody would be nervous when threatened by a man with a gun") and agent-specific knowledge ("Joe was fearless because he was trained in martial arts"). For another, they critically rely

on perceived facts of the concrete situation—such as what is happening to the agent, the agent's facial expressions and behaviors, and what the person saw or didn't see.

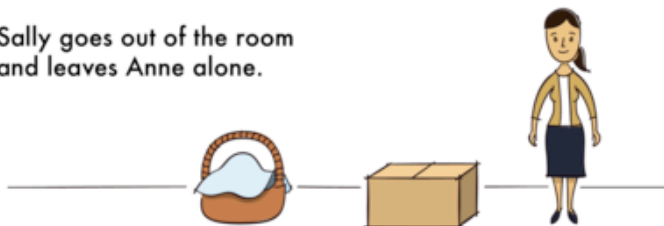
This capacity of integrating multiple lines of information into a mental-state inference develops steadily within the first few years of life, and this process has led to a substantial body of research (**Wellman, Cross, & Watson, 2001**). The research began with a clever experiment by Wimmer and Perner (**1983**), who tested whether children can pass a **false-belief test** (see Figure 2). The child is shown a picture story of Sally, who puts her ball in a basket and leaves the room. While Sally is out of the room, Anne comes along and takes the ball from the basket and puts it inside a box. The child is then asked *where* Sally thinks the ball is located when she comes back to the room. Is she going to look first *in the box* or *in the basket*?

The right answer is that she will look in the basket, because that's where she put it and thinks it is; but we have to infer this *false belief* against our own better knowledge that the ball is in the box. This is very difficult for children before the age of 4, and it usually takes some cognitive effort in adults (**Epley, Morewedge, & Keysar, 2004**).

The challenge is clear: People are good at automatically relating to other people, using their own minds as a fitting model for others' minds. But people need to recognize when to step out of their own perspective and truly represent the other person's perspective—which may harbor very different thoughts, feelings, and intentions.



Sally goes out of the room and leaves Anne alone.



Anne takes the ball out of the basket . . .



When Sally comes back . . .



Where will Sally look for her ball?

Figure 2. Sally–Anne task to test children’s ability to infer false beliefs.

Tools in Summary

We have seen that the human understanding of other minds relies on many tools. People process such information as motion, faces, and gestures and categorize it into such concepts as agent, intentional action, or fear. They rely on relatively automatic psychological processes, such as imitation, joint attention, and projection. And they rely on more effortful processes, such as simulation and mental-state inference. These processes all link behavior that humans observe to mental states that humans infer. If we call this stunning capacity a “theory,” it is a theory of mind *and* behavior.

Folk Explanations of Behavior

Nowhere is this mind–behavior link clearer than in **people’s explanations of behavior**—when they try to understand why somebody acted or felt a certain way. People have a strong need to answer such “why” questions, from the trivial to the significant: why the neighbor’s teenage daughter is wearing a short skirt in the middle of winter; why the policeman is suddenly so friendly; why the murderer killed three people. The need to explain this last behavior seems puzzling, because typical benefits of explanation are absent: We do not need to predict or control the criminal’s behavior since we will never have anything to do with him. Nonetheless, we have an insatiable desire to *understand*, to find *meaning* in this person’s behavior—and in people’s behavior generally.

Older theories of how people explain and understand behavior suggested that people merely identify causes of the behavior (e.g., **Kelley, 1967**). That is true for most unintentional behaviors—tripping, having a headache, calling someone by the wrong name. But to



When people behave in ways that don't make sense to us we often feel compelled to come up with reasonable explanations. What are their motives? What circumstances would lead to this? How could this happen? [Image: lwpkommunikacio, <https://goo.gl/5xISAN>, CC BY 2.0, <https://goo.gl/axKpvj>]

explain *intentional* behaviors, people use a more sophisticated framework of interpretation, which follows directly from their concept of intentionality and the associated mental states they infer (**Malle, 2004**). We have already mentioned the complexity of people's concept of intentionality; here it is in full (Malle & Knobe, **1997**): For an agent to perform a behavior intentionally, she must have a desire for an outcome (what we had called a goal), beliefs about how a particular action leads to the outcome, and an intention to perform that action; if the agent then actually performs the action with awareness and skill, people take it to be an intentional action. To explain *why* the agent performed the action, humans try to make the inverse inference of *what desire* and *what beliefs* the agent had that led her to so act, and these inferred desires and beliefs are the *reasons* for which she acted. What was her reason for wearing a short skirt in the winter? "She wanted to annoy her mother." What was the policeman's reason for suddenly being so nice? "He thought he was speaking with an influential

politician.” What was his reason for killing three people? In fact, with such extreme actions, people are often at a loss for an answer. If they do offer an answer, they frequently retreat to “causal history explanations” (Malle, 1999), which step outside the agent’s own reasoning and refer instead to more general background facts—for example, that he was mentally ill or a member of an extremist group. But people clearly prefer to explain others’ actions by referring to their beliefs and desires, the specific reasons for which they acted.

By relying on a theory of mind, explanations of behavior make meaningful what would otherwise be inexplicable motions—just like in our initial example of two persons passing some object between them. We recognize that the customer wanted to pay and that’s why they passed their credit card to the cashier, who in turn knew that they were given a credit card and swiped it. It all seems perfectly clear, almost trivial to us. But that is only because humans have a theory of mind and use it to retrieve the relevant knowledge, simulate the other people’s perspective, infer beliefs and desires, and explain what a given action means. Humans do this effortlessly and often accurately. Moreover, they do it within seconds or less. What’s so special about that? Well, it takes years for a child to develop this capacity, and it took our species a few million years to evolve it. That’s pretty special.

Check Your Knowledge

To help you with your studying, we’ve included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You

can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Automatic empathy

A social perceiver unwittingly taking on the internal state of another person, usually because of mimicking the person's expressive behavior and thereby feeling the expressed emotion.

False-belief test

An experimental procedure that assesses whether a perceiver recognizes that another person has a false belief—a belief that contradicts reality.

Folk explanations of behavior

People's natural explanations for why somebody did something, felt something, etc. (differing substantially for unintentional and intentional behaviors).

Intention

An agent's mental state of committing to perform an action that the agent believes will bring about a desired outcome.

Intentionality

The quality of an agent's performing a behavior intentionally—that is, with skill and awareness and executing an intention (which is in turn based on a desire and relevant beliefs).

Joint attention

Two people attending to the same object and being aware that they both are attending to it.

Mimicry

Copying others' behavior, usually without awareness.

Mirror neurons

Neurons identified in monkey brains that fire both when the monkey performs a certain action and when it perceives another agent performing that action.

Projection

A social perceiver's assumption that the other person wants, knows, or feels the same as the perceiver wants, know, or feels.

Simulation

The process of representing the other person's mental state.

Synchrony

Two people displaying the same behaviors or having the same internal states (typically because of mutual mimicry).

Theory of mind

The human capacity to understand minds, a capacity that is made up of a collection of concepts (e.g., agent, intentionality) and processes (e.g., goal detection, imitation, empathy, perspective taking).

Visual perspective taking

Can refer to visual perspective taking (perceiving something from another person's spatial vantage point) or more generally to effortful mental state inference (trying to infer the other person's thoughts, desires, emotions).

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PSYC 100 XIII

COGNITIVE DEVELOPMENT

36. Categories and Concepts

Original chapter by Gregory Murphy adapted by the Queen's University Psychology Department

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

People form mental concepts of categories of objects, which permit them to respond appropriately to new objects they encounter. Most concepts cannot be strictly defined but are organized around the “best” examples or prototypes, which have the properties most common in the category. Objects fall into many different categories, but there is usually a most salient one, called the basic-level category, which is at an intermediate level of specificity (e.g., chairs, rather than furniture or desk chairs). Concepts are closely related to our knowledge of the world, and people can more easily learn concepts that are consistent with their knowledge. Theories of concepts argue either that people learn a summary description of a whole category or else that they learn exemplars of the category. Recent research suggests that there are different ways to learn and represent concepts and that they are accomplished by different neural systems.

Learning Objectives

- Understand the problems with attempting to define

categories.

- Understand typicality and fuzzy category boundaries.
- Learn about theories of the mental representation of concepts.
- Learn how knowledge may influence concept learning.

Introduction



Although you've (probably) never seen this particular truck before, you know a lot about it because of the knowledge you've accumulated in the past about the features in the category of trucks. [Image: CCO Public Domain, <https://goo.gl/m25gce>]

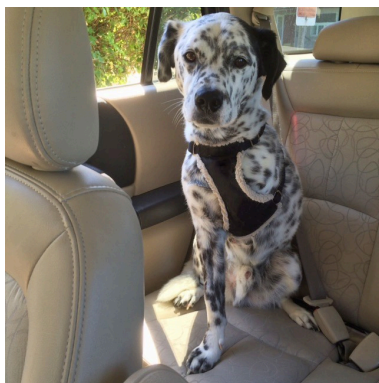
Consider the following set of objects: some dust, papers, a computer monitor, two pens, a cup, and an orange. What do these things have in common? Only that they all happen to be on my desk as I write this. This set of things can be considered a **category**, a set of objects that can be treated as equivalent in some way. But, most of our categories seem much more informative—they share many properties. For example, consider the following categories: trucks,

wireless devices, weddings, psychopaths, and trout. Although the objects in a given category are different from one another, they have many commonalities. When you know something is a truck, you know quite a bit about it. The psychology of categories concerns how people learn, remember, and use informative categories such as trucks or psychopaths. The mental representations we form of categories are called **concepts**. There is a category of trucks in the world, and

I also have a concept of trucks in my head. We assume that people's concepts correspond more or less closely to the actual category, but it can be useful to distinguish the two, as when someone's concept is not really correct. Concepts are at the core of intelligent behavior. We expect people to be able to know what to do in new situations and when confronting new objects. If you go into a new classroom and see chairs, a blackboard, a projector, and a screen, you know what these things are and how they will be used. You'll sit on one of the chairs and expect the instructor to write on the blackboard or project something onto the screen. You do this *even if you have never seen any of these particular objects before*, because you have concepts of classrooms, chairs, projectors, and so forth, that tell you what they are and what you're supposed to do with them. Furthermore, if someone tells you a new fact about the projector—for example, that it has a halogen bulb—you are likely to extend this fact to other projectors you encounter. In short, concepts allow you to extend what you have learned about a limited number of objects to a potentially infinite set of entities. You know thousands of categories, most of which you have learned without careful study or instruction. Although this accomplishment may seem simple, we know that it isn't, because it is difficult to program computers to solve such intellectual tasks. If you teach a learning program that a robin, a swallow, and a duck are all birds, it may not recognize a cardinal or peacock as a bird. As we'll shortly see, the problem is that objects in categories are often surprisingly diverse. Simpler organisms, such as animals and human infants, also have concepts (**Mareschal, Quinn, & Lea, 2010**). Squirrels may have a concept of predators, for example, that is specific to their own lives and experiences. However, animals likely have many fewer concepts and cannot understand complex concepts such as mortgages or musical instruments.

Nature of Categories

Traditionally, it has been assumed that categories are *well-defined*. This means that you can give a definition that specifies what is in and out of the category. Such a definition has two parts. First, it provides the *necessary features* for category membership: What must objects have in order to be in it? Second, those features must be *jointly sufficient* for membership: If an object has those features, then it is in the category. For example, if I



Here is a very good dog, but one that does not fit perfectly into a well-defined category where all dogs have four legs. [Image: State Farm, <https://goo.gl/KHtu6N>, CC BY 2.0, <https://goo.gl/BRvSA7>]

defined a dog as a four-legged animal that barks, this would mean that every dog is four-legged, an animal, and barks, and also that anything that has all those properties is a dog. Unfortunately, it has not been possible to find definitions for many familiar categories. Definitions are neat and clear-cut; the world is messy and often unclear. For example, consider our definition of dogs. In reality, not all dogs have four legs; not all dogs bark. I knew a dog that lost her bark with age (this was an improvement); no one doubted that she was still a dog. It is often possible to find some necessary features (e.g., all dogs have blood and breathe), but these features are generally not sufficient to determine category membership (you also have blood and breathe but are not a dog). Even in domains where one might expect to find clear-cut definitions, such as science and law, there are often problems. For example, many people were upset when Pluto was downgraded from its status as a

planet to a dwarf planet in 2006. Upset turned to outrage when they discovered that there was no hard-and-fast definition of planethood: “Aren’t these astronomers scientists? Can’t they make a simple definition?” In fact, they couldn’t. After an astronomical organization tried to make a definition for planets, a number of astronomers complained that it might not include accepted planets such as Neptune and refused to use it. If everything looked like our Earth, our moon, and our sun, it would be easy to give definitions of planets, moons, and stars, but the universe has sadly not conformed to this ideal.

Fuzzy Categories

Borderline Items

Experiments also showed that the psychological assumptions of well-defined categories were not correct. Hampton (1979) asked subjects to judge whether a number of items were in different categories. He did not find that items were either clear members or clear nonmembers. Instead, he found many items that were just barely considered category members and others that were just barely not members, with much disagreement among subjects. Sinks were barely considered as members of the kitchen utensil category, and sponges were barely excluded. People just included seaweed as a vegetable and just barely excluded tomatoes and gourds. Hampton found that members and nonmembers formed a continuum, with no obvious break in people’s membership judgments. If categories were well defined, such examples should be very rare. Many studies since then have found such *borderline members* that are not clearly in or clearly out of the category.

Furniture	Fruit
chair	orange
table	banana
desk	pear
bookcase	plum
lamp	strawberry
cushion	pineapple
rug	lemon
stove	honeydew
picture	date
vase	tomato

Table 1. Examples of two categories, with members ordered by typicality (from Rosch & Mervis, 1975)

McCloskey and Glucksberg (1978) found further evidence for borderline membership by asking people to judge category membership twice, separated by two weeks. They found that when people made repeated category judgments such as “Is an olive a fruit?” or “Is a sponge a kitchen utensil?” they changed their minds about borderline items—up to 22 percent of the time. So, not only do people disagree with one another about borderline items,

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Typicality

A related finding that turns out to be most important is that even among items that clearly are in a category, some seem to be “better” members than others (Rosch, 1973). Among birds,

they disagree with themselves! As a result, researchers often say that categories are fuzzy, that is, they have unclear boundaries that can shift over time.

for example, robins and sparrows are very **typical**. In contrast, ostriches and penguins are very *atypical* (meaning not

typical). If someone says, "There's a bird in my yard," the image you have will be of a smallish passerine bird such as a robin, not an eagle or hummingbird or turkey.

You can find out which category members are typical merely by asking people. Table 1 shows a list of category members in order of their rated typicality. Typicality is perhaps the most important variable in predicting how people interact with categories. The following text box is a partial list of what typicality influences.

We can understand the two phenomena of borderline members and typicality as two sides of the same coin. Think of the most typical category member: This is often called the category *prototype*. Items that are less and less similar to the prototype become less and less typical. At some point, these less typical items become so atypical that you start to doubt whether they are in the category at all. Is a rug really an example of furniture? It's in the home like chairs and tables, but it's also different from most furniture in its structure and use. From day to day, you might change your mind as to whether this atypical example is in or out of the category. So, changes in typicality ultimately lead to borderline members.

Influences of Typicality on Cognition

- **Typical items are judged category members more often** (Hampton, 1979).
- **Speed of categorization is faster for typical items** (Rips, Shoben, & Smith, 1973).
- **Typical members are learned before atypical ones** (Rosh

&Mervis).

- **Learning a category is easier if typical examples are provided** (Mervis & Pani).
- **In language comprehension, references to typical members are understood more easily** (Garrod & Sanford, 1977).
- **In language production, people tend to say typical items before atypical ones (e.g., “apples and lemons rather than “lemons and apples”)** (Onishi, Murphy, & Bock, 2008).

Source of Typicality

Intuitively, it is not surprising that robins are better examples of birds than penguins are, or that a table is a more typical kind of furniture than is a rug. But given that robins and penguins are known to be birds, why should one be more typical than the other? One possible answer is the frequency with which we encounter the object: We see a lot more robins than penguins, so they must be more typical. Frequency does have some effect, but it is actually not the most important variable (**Rosch, Simpson, & Miller, 1976**). For example, I see both rugs and tables every single day, but one of them is much more typical as furniture than the other.

The best account of what makes something typical comes from Rosch and Mervis's (1975) *family resemblance theory*. They proposed that items are likely to be typical if they (a) have the features that are frequent in the category and (b) do not have features frequent in other categories. Let's compare two extremes, robins and penguins. Robins are small flying birds that sing, live in nests in trees, migrate in winter, hop around on your lawn, and so on. Most of these properties are found in many other birds. In contrast, penguins do not fly, do not sing, do not live in nests or in trees, do not hop around on your lawn.

Furthermore, they have properties that are common in other categories, such as swimming expertly and having wings that look and act like fins. These properties are more often found in fish than in birds.



When you think of “bird,” how closely does the robin resemble your general figure? [Image: CC0 Public Domain, <https://goo.gl/m25gce>]

According to Rosch and Mervis, then, it is not because a robin is a very common bird that makes it typical. Rather, it is because the robin has the shape, size, body parts, and behaviors that are very common among birds—and not common among fish, mammals, bugs, and so forth. In a classic experiment, Rosch and Mervis (1975) made up two new categories, with arbitrary features. Subjects viewed example

after example and had to learn which example was in which category. Rosch and Mervis constructed some items that had features that were common in the category and other items that had features less common in the category. The subjects learned the first type of item before they learned the second type. Furthermore, they then rated the items with common features as more typical. In another experiment, Rosch and Mervis constructed items that differed in how many features were shared with a *different* category. The more features were shared, the longer it took subjects to learn which category the item was in. These experiments, and many later studies, support both parts of the family resemblance theory.

Category Hierarchies

Many important categories fall into *hierarchies*, in which more concrete categories are nested inside larger, abstract categories. For example, consider the categories: brown bear, bear, mammal, vertebrate, animal, entity. Clearly, all brown bears are bears; all bears are mammals; all mammals are vertebrates; and so on. Any given object typically does not fall into just one category—it could be in a dozen different categories, some of which are structured in this hierarchical manner. Examples of biological categories come to mind most easily, but within the realm of human artifacts, hierarchical structures can readily be found: desk chair, chair, furniture, artifact, object.

Brown (1958), a child language researcher, was perhaps the first to note that there seems to be a preference for which category we use to label things. If your office desk chair is in the way, you'll probably say, "Move that chair," rather than "Move that desk chair" or "piece of furniture." Brown thought that the use of a single, consistent name probably helped children to learn the name for things. And, indeed, children's first labels for categories tend to be exactly those names that adults prefer to use (Anglin, 1977).

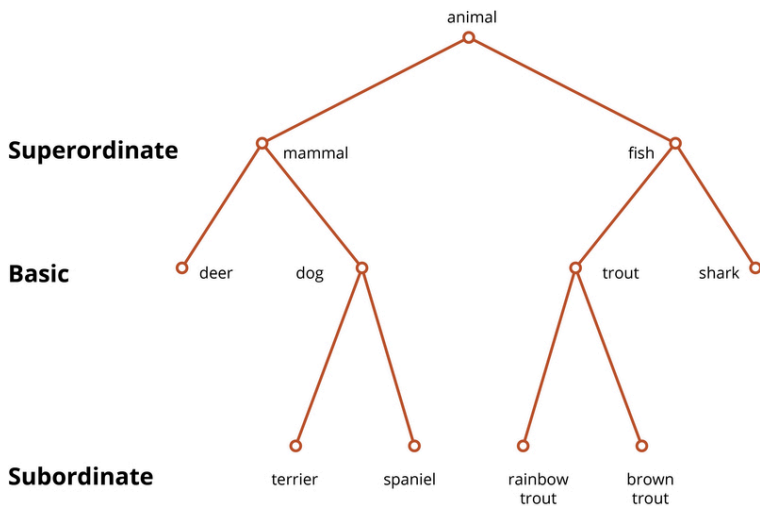


Figure 1. This is a highly simplified illustration of hierarchically organized categories, with the superordinate, basic, and subordinate levels labeled. Keep in mind that there may be even more specific subordinates (e.g., wire-haired terriers) and more general superordinates (e.g., living thing)

This preference is referred to as a preference for the **basic level of categorization**, and it was first studied in detail by Eleanor Rosch and her students (Rosch, Mervis, Gray, Johnson, & Boyes-Braem, 1976). The basic level represents a kind of Goldilocks effect, in which the category used for something is not too small (northern brown bear) and not too big (animal), but is just right (bear). The simplest way to identify an object's basic-level category is to discover how it would be labeled in a neutral situation. Rosch et al. (1976) showed subjects pictures and asked them to provide the first name that came to mind. They found that 1,595 names were at the basic level, with 14 more specific names (*subordinates*) used. Only once did anyone use a more general name (*superordinate*). Furthermore, in printed text, basic-level labels are much more

frequent than most subordinate or superordinate labels (e.g., **Wisniewski & Murphy, 1989**).

The preference for the basic level is not merely a matter of labeling. Basic-level categories are usually easier to learn. As Brown noted, children use these categories first in language learning, and superordinates are especially difficult for children to fully acquire. People are faster at identifying objects as members of basic-level categories (**Rosch et al., 1976**).

Rosch et al. (1976) initially proposed that basic-level categories cut the world at its joints, that is, merely reflect the big differences between categories like chairs and tables or between cats and mice that exist in the world. However, it turns out that which level is basic is not universal. North Americans are likely to use names like *tree*, *fish*, and *bird* to label natural objects. But people in less industrialized societies seldom use these labels and instead use more specific words, equivalent to *elm*, *trout*, and *finch* (**Berlin, 1992**). Because Americans and many other people living in industrialized societies know so much less than our ancestors did about the natural world, our basic level has “moved up” to what would have been the superordinate level a century ago. Furthermore, experts in a domain often have a preferred level that is more specific than that of non-experts. Birdwatchers see sparrows rather than just birds, and carpenters see roofing hammers rather than just hammers (**Tanaka & Taylor, 1991**). This all suggests that the preferred level is not (only) based on how different categories are in the world, but that people’s knowledge and interest in the categories has an important effect.

One explanation of the basic-level preference is that basic-level categories are more *differentiated*: The category members are similar to one another, but they are different from members of other categories (**Murphy & Brownell, 1985; Rosch et al., 1976**). (The alert reader will note a similarity to the explanation of typicality I gave above. However, here we’re talking about the entire category and not individual members.)

Chairs are pretty similar to one another, sharing a lot of features (legs, a seat, a back, similar size and shape); they also don't share that many features with other furniture. Superordinate categories are not as useful because their members are not very similar to one another. What features are common to most furniture? There are very few. Subordinate categories are not as useful, because they're very similar to other categories: Desk chairs are quite similar to dining room chairs and easy chairs. As a result, it can be difficult to decide which subordinate category an object is in (**Murphy & Brownell, 1985**). Experts can differ from novices in which categories are the most differentiated, because they know different things about the categories, therefore changing how similar the categories are.

[1] This is a controversial claim, as some say that infants learn superordinates before anything else (**Mandler, 2004**). However, if true, then it is very puzzling that older children have great difficulty learning the correct meaning of words for superordinates, as well as in learning artificial superordinate categories (**Horton & Markman, 1980; Mervis, 1987**). However, it seems fair to say that the answer to this question is not yet fully known.

Theories of Concept Representation

Now that we know these facts about the psychology of concepts, the question arises of how concepts are mentally represented. There have been two main answers. The first, somewhat confusingly called the *prototype theory* suggests that people have a *summary representation* of the category, a mental description that is meant to apply to the category as a whole. (The significance of *summary* will become apparent

when the next theory is described.) This description can be represented as a set of *weighted features* (Smith & Medin, 1981). The features are weighted by their frequency in the category. For the category of birds, having wings and feathers would have a very high weight; eating worms would have a lower weight; living in Antarctica would have a lower weight still, but not zero, as some birds do live there.



If you were asked, “What kind of animal is this?” according to prototype theory, you would consult your summary representations of different categories and then select the one that is most similar to this image—probably a lizard! [Image: Adhi Rachdian, <https://goo.gl/dQyUwf>, CC BY 2.0, <https://goo.gl/BRvSA7>]

The idea behind prototype theory is that when you learn a category, you learn a general description that applies to the category as a whole: Birds have wings and usually fly; some eat worms; some swim underwater to catch fish. People can state these generalizations, and sometimes we learn about categories by reading or hearing such statements (“The komodo dragon can grow to be 10 feet long”). When you try to classify an item, you see how well it matches that weighted list of

features. For example, if you saw something with wings and feathers fly onto your front lawn and eat a worm, you could (unconsciously) consult your concepts and see which ones contained the features you observed. This example possesses many of the highly weighted bird features, and so it should be easy to identify as a bird. This theory readily explains the phenomena we discussed earlier. Typical category members have more, higher-weighted features. Therefore, it is easier to match them to your conceptual representation. Less typical items have fewer or lower-weighted features (and they may

have features of other concepts). Therefore, they don't match your representation as well. This makes people less certain in classifying such items. Borderline items may have features in common with multiple categories or not be very close to any of them. For example, edible seaweed does not have many of the common features of vegetables but also is not close to any other food concept (meat, fish, fruit, etc.), making it hard to know what kind of food it is. A very different account of concept representation is the *exemplar theory* (**exemplar** being a fancy name for an example; **Medin & Schaffer, 1978**). This theory denies that there is a summary representation. Instead, the theory claims that your concept of vegetables is remembered examples of vegetables you have seen. This could of course be hundreds or thousands of exemplars over the course of your life, though we don't know for sure how many exemplars you actually remember. How does this theory explain classification? When you see an object, you (unconsciously) compare it to the exemplars in your memory, and you judge how similar it is to exemplars in different categories. For example, if you see some object on your plate and want to identify it, it will probably activate memories of vegetables, meats, fruit, and so on. In order to categorize this object, you calculate how similar it is to each exemplar in your memory. These similarity scores are added up for each category. Perhaps the object is very similar to a large number of vegetable exemplars, moderately similar to a few fruit, and only minimally similar to some exemplars of meat you remember. These similarity scores are compared, and the category with the highest score is chosen. Why would someone propose such a theory of concepts? One answer is that in many experiments studying concepts, people learn concepts by seeing exemplars over and over again until they learn to classify them correctly. Under such conditions, it seems likely that people eventually memorize the exemplars (**Smith & Minda, 1998**). There is also evidence that *close similarity* to well-remembered objects has

a large effect on classification. Allen and Brooks (1991) taught people to classify items by following a rule. However, they also had their subjects study the items, which were richly detailed. In a later test, the experimenters gave people new items that were very similar to one of the old items but were in a different category. That is, they changed one property so that the item no longer followed the rule. They discovered that people were often fooled by such items. Rather than following the category rule they had been taught, they seemed to recognize the new item as being very similar to an old one and so put it, incorrectly, into the same category. Many experiments have been done to compare the prototype and exemplar theories. Overall, the exemplar theory seems to have won most of these comparisons. However, the experiments are somewhat limited in that they usually involve a small number of exemplars that people view over and over again. It is not so clear that exemplar theory can explain real-world classification in which people do not spend much time learning individual items (how much time do you spend studying squirrels? or chairs?). Also, given that some part of our knowledge of categories is learned through general statements we read or hear, it seems that there must be room for a summary description separate from exemplar memory. Many researchers would now acknowledge that concepts are represented through multiple cognitive systems. For example, your knowledge of dogs may be in part through general descriptions such as “dogs have four legs.” But you probably also have strong memories of some exemplars (your family dog, Lassie) that influence your categorization. Furthermore, some categories also involve rules (e.g., a strike in baseball). How these systems work together is the subject of current study.

Knowledge

The final topic has to do with how concepts fit with our broader knowledge of the world. We have been talking very generally about people learning the features of concepts. For example, they see a number of birds and then learn that birds generally have wings, or perhaps they remember bird exemplars. From this perspective, it makes no difference what those exemplars or features are—people just learn them. But consider two possible concepts of buildings and their features in Table 2.

Donker	Blegdav
has thick windows	has steel windows
is red	is purple
divers live there	farmers live there
is under water	is in the desert
get there by submarine	get there by submarine
has fish as pets	has polar bears as pets

Table 2. Examples of two fictional concepts

Imagine you had to learn these two concepts by seeing exemplars of them, each exemplar having some of the features listed for the concept (as well as some idiosyncratic features). Learning the donker concept would be pretty easy. It seems to be a kind of underwater building, perhaps for deep-sea explorers. Its features seem to go together. In contrast, the blegdav doesn't really make sense. If it's in the desert, how can you get there by submarine, and why do they have polar bears as pets? Why would farmers live in the desert or use submarines? What good would steel windows do in such a building? This concept seems peculiar. In fact, if people are asked to learn new concepts that make sense, such as donkers, they learn them quite a bit faster than concepts such as blegdavs that don't make sense (Murphy & Allopenna, 1994). Furthermore, the features that seem connected to one another (such as being underwater and getting there by submarine) are learned better than features that don't seem related to the others (such as being red).

Such effects demonstrate that when we learn new concepts, we try to connect them to the knowledge we already have about the world. If you were to learn about a new animal that doesn't seem to eat or reproduce, you would be very puzzled and think that you must have gotten something wrong. By themselves, the prototype and exemplar theories don't predict this. They simply say that you learn descriptions or exemplars, and they don't put any constraints on what those descriptions or exemplars are. However, the *knowledge approach* to concepts emphasizes that concepts are meant to tell us about real things in the world, and so our knowledge of the world is used in learning and thinking about concepts.

We can see this effect of knowledge when we learn about new pieces of technology. For example, most people could easily learn about tablet computers (such as iPads) when they were first introduced by drawing on their knowledge of laptops, cell phones, and related technology. Of course, this reliance on past knowledge can also lead to errors, as when people don't learn about features of their new tablet that weren't present in their cell phone or expect the tablet to be able to do something it can't.

One important aspect of people's knowledge about categories is called **psychological essentialism** (Gelman, 2003; Medin & Ortony, 1989). People tend to believe that some categories—most notably natural kinds such as animals, plants, or minerals—have an underlying property that is found only in that category and that causes its other features. Most categories don't actually have essences, but this is sometimes a firmly held belief. For example, many people will state that there is something about dogs, perhaps some specific gene or set of genes, that all dogs have and that makes them bark, have fur, and look the way they do. Therefore, decisions about whether something is a dog do not depend only on features that you can easily see but also on the assumed presence of this cause.

Belief in an essence can be revealed through experiments describing fictional objects. Keil (1989) described to adults and children a fiendish operation in which someone took a raccoon, dyed its hair black with a white stripe down the middle, and implanted a “sac of super-smelly yucky stuff” under its tail. The subjects were shown a picture of a skunk and told that this is now what the animal looks like. What is it? Adults and children over the age of 4 all agreed that the animal is still



Although it may seem natural that different species have an unchangeable “essence,” consider evolution and everything’s development from common ancestors. [Image: Marc Dragiewicz, <https://goo.gl/E9v4eR>, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

a raccoon. It may look and even act like a skunk, but a raccoon cannot change its stripes (or whatever!)—it will always be a raccoon. Importantly, the same effect was not found when Keil described a coffeepot that was operated on to look like and function as a bird feeder. Subjects agreed that it was now a bird feeder. Artifacts don’t have an essence. Signs of essentialism include (a) objects are believed to be either in or out of the category, with no in-between; (b) resistance to change of category membership or of properties connected to the essence; and (c) for living things, the essence is passed on to progeny. Essentialism is probably helpful in dealing with much of the natural world, but it may be less helpful when it is applied to humans. Considerable evidence suggests that people think of gender, racial, and ethnic groups as having essences, which serves to emphasize the difference between groups and even justify discrimination (Hirschfeld, 1996). Historically, group differences were described by inheriting the

blood of one's family or group. "Bad blood" was not just an expression but a belief that negative properties were inherited and could not be changed. After all, if it is in the nature of "those people" to be dishonest (or clannish or athletic ...), then that could hardly be changed, any more than a raccoon can change into a skunk. Research on categories of people is an exciting ongoing enterprise, and we still do not know as much as we would like to about how concepts of different kinds of people are learned in childhood and how they may (or may not) change in adulthood. Essentialism doesn't apply only to person categories, but it is one important factor in how we think of groups.

Conclusion

Concepts are central to our everyday thought. When we are planning for the future or thinking about our past, we think about specific events and objects in terms of their categories. If you're visiting a friend with a new baby, you have some expectations about what the baby will do, what gifts would be appropriate, how you should behave toward it, and so on. Knowing about the category of babies helps you to effectively plan and behave when you encounter this child you've never seen before.

Learning about those categories is a complex process that involves seeing exemplars (babies), hearing or reading general descriptions ("Babies like black-and-white pictures"), general knowledge (babies have kidneys), and learning the occasional rule (all babies have a rooting reflex). Current research is focusing on how these different processes take place in the brain. It seems likely that these different aspects of concepts are accomplished by different neural structures (**Maddox & Ashby, 2004**).

Another interesting topic is how concepts differ across cultures. As different cultures have different interests and different kinds of interactions with the world, it seems clear that their concepts will somehow reflect those differences. On the other hand, the structure of categories in the world also imposes a strong constraint on what kinds of categories are actually useful. Some researchers have suggested that differences between Eastern and Western modes of thought have led to qualitatively different kinds of concepts (e.g., **Norenzayan, Smith, Kim, & Nisbett, 2002**). Although such differences are intriguing, we should also remember that different cultures seem to share common categories such as chairs, dogs, parties, and jars, so the differences may not be as great as suggested by experiments designed to detect cultural effects. The interplay of culture, the environment, and basic cognitive processes in establishing concepts has yet to be fully investigated.

Vocabulary

Basic-level category

The neutral, preferred category for a given object, at an intermediate level of specificity.

Category

A set of entities that are equivalent in some way. Usually the items are similar to one another.

Concept

The mental representation of a category.

Exemplar

An example in memory that is labeled as being in a particular category.

Psychological essentialism

The belief that members of a category have an unseen property that causes them to be in the category and to have the properties associated with it.

Typicality

The difference in “goodness” of category members, ranging from the most typical (the prototype) to borderline members.

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37. Cognitive Development in Childhood

Original chapter by Robert Siegler adapted by the Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen’s Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

This module examines what cognitive development is, major theories about how it occurs, the roles of nature and nurture, whether it is continuous or discontinuous, and how research in the area is being used to improve education.

Learning Objectives

- Be able to identify and describe the main areas of cognitive development.
- Be able to describe major theories of cognitive development and what distinguishes them.
- Understand how nature and nurture work together to produce cognitive development.

- Understand why cognitive development is sometimes viewed as discontinuous and sometimes as continuous.
- Know some ways in which research on cognitive development is being used to improve education.

Introduction

By the time you reach adulthood you have learned a few things about how the world works. You know, for instance, that you can't walk through walls or leap into the tops of trees. You know that although you cannot see your car keys they've got to be around here someplace. What's more, you know that if you want to communicate complex ideas like ordering a triple-shot soy vanilla latte with chocolate sprinkles it's better to use words with meanings attached to them rather than simply gesturing and grunting. People accumulate all this useful knowledge through the process of cognitive development, which involves a multitude of factors, both inherent and learned.

Cognitive development refers to the development of thinking across the lifespan. Defining thinking can be problematic, because no clear boundaries separate thinking from other mental activities. Thinking obviously involves the higher mental processes: problem solving, reasoning, creating, conceptualizing, categorizing, remembering, planning, and so on. However, thinking also involves other mental processes that seem more



Cognitive development in childhood is about change. From birth to adolescence a young person's mind changes dramatically in many important ways. [Image: One Laptop per Child, <https://goo.gl/L1eAsO>, CC BY 2.0, <https://goo.gl/9uSnqN>]

basic and at which even toddlers are skilled—such as perceiving objects and events in the environment, acting skillfully on objects to obtain goals, and understanding and producing language. Yet other areas of human development that involve thinking are not usually associated with cognitive development, because thinking isn't a prominent feature of them—such as personality and temperament.

As the name suggests, cognitive development is about change. Children's thinking changes in dramatic and surprising ways. Consider DeVries's (1969) study of whether young children understand the difference between appearance and reality. To find out, she brought an unusually even-tempered cat named Maynard to a psychology laboratory and allowed the 3- to 6-year-old participants in the study to pet and play with him. DeVries then put a mask of a fierce dog on Maynard's head, and asked the children what Maynard was. Despite all of the children having identified Maynard previously as a cat, now most 3-year-olds said that he was a dog and

claimed that he had a dog's bones and a dog's stomach. In contrast, the 6-year-olds weren't fooled; they had no doubt that Maynard remained a cat. Understanding how children's thinking changes so dramatically in just a few years is one of the fascinating challenges in studying cognitive development.

There are several main types of theories of child development. Stage theories, such as **Piaget's stage theory**, focus on whether children progress through qualitatively different stages of development. **Sociocultural theories**, such as that of Lev Vygotsky, emphasize how other people and the attitudes, values, and beliefs of the surrounding culture, influence children's development. **Information processing theories**, such as that of David Klahr, examine the mental processes that produce thinking at any one time and the transition processes that lead to growth in that thinking.

At the heart of all of these theories, and indeed of all research on cognitive development, are two main questions: (1) How do nature and nurture interact to produce cognitive development? (2) Does cognitive development progress through qualitatively distinct stages? In the remainder of this module, we examine the answers that are emerging regarding these questions, as well as ways in which cognitive developmental research is being used to improve education.

Nature and Nurture

The most basic question about child development is how nature and nurture together shape development. **Nature** refers to our biological endowment, the genes we receive from our parents. **Nurture** refers to the environments, social as well as physical, that influence our development, everything from the womb in which we develop before birth to the homes in which we grow up, the schools we attend, and the many people with whom we interact.

The nature-nurture issue is often presented as an either-or question: Is our intelligence (for example) due to our genes or to the environments in which we live? In fact, however, every aspect of development is produced by the interaction of genes and environment. At the most basic level, without genes, there would be no child, and without an environment to provide nurture, there also would be no child.

The way in which nature and nurture work together can be seen in findings on visual development. Many people view vision as something that people either are born with or that is purely a matter of biological maturation, but it also depends on the right kind of experience at the right time. For example, development of **depth perception**, the ability to actively perceive the distance from oneself to objects in the environment, depends on seeing patterned light and having normal brain activity in response to the patterned light, in infancy (**Held, 1993**). If no patterned light is received, for example when a baby has severe cataracts or blindness that is not surgically corrected until later in development, depth perception remains abnormal even after the surgery.



A child that is perceived to be attractive and calm may receive a different sort of care and attention from adults and as a result enjoy a developmental advantage.

[Image: Cairn 11], <https://goo.gl/6RpBVt>, CC BY-NC-SA 2.0, <https://goo.gl/HEXbAA>

Adding to the complexity of the nature-nurture interaction, children's genes lead to their eliciting different treatment from other people, which influences their cognitive development. For example, infants' physical attractiveness and temperament are influenced considerably by their genetic inheritance, but it is also the case that parents provide more sensitive and affectionate care to easygoing and attractive infants than to difficult and

less attractive ones, which can contribute to the infants' later cognitive development (Langlois et al., **1995**; van den Boom & Hoeksma, **1994**).

Also contributing to the complex interplay of nature and nurture is the role of children in shaping their own cognitive development. From the first days out of the womb, children actively choose to attend more to some things and less to others. For example, even 1-month-olds choose to look at their mother's face more than at the faces of other women of the same age and general level of attractiveness (Bartrip, Morton, & de Schonen, **2001**). Children's contributions to their own cognitive development grow larger as they grow older (**Scarr & McCartney, 1983**). When children are young, their parents largely determine their experiences: whether they will attend day care, the children with whom they will have play dates, the books to which they have access, and so on. In contrast, older children and adolescents choose their environments to a larger degree. Their parents' preferences largely determine

how 5-year-olds spend time, but 15-year-olds' own preferences largely determine when, if ever, they set foot in a library. Children's choices often have large consequences. To cite one example, the more that children choose to read, the more that their reading improves in future years (**Baker, Dreher, & Guthrie, 2000**). Thus, the issue is not whether cognitive development is a product of nature or nurture; rather, the issue is how nature and nurture work together to produce cognitive development.

Does Cognitive Development Progress Through Distinct Stages?

Some aspects of the development of living organisms, such as the growth of the width of a pine tree, involve **quantitative changes**, with the tree getting a little wider each year. Other changes, such as the life cycle of a ladybug, involve **qualitative changes**, with the creature becoming a totally different type of entity after a transition than before (Figure 1). The existence of both gradual, quantitative changes and relatively sudden, qualitative changes in the world has led researchers who study cognitive development to ask whether changes in children's thinking are gradual and **continuous** or sudden and **discontinuous**.

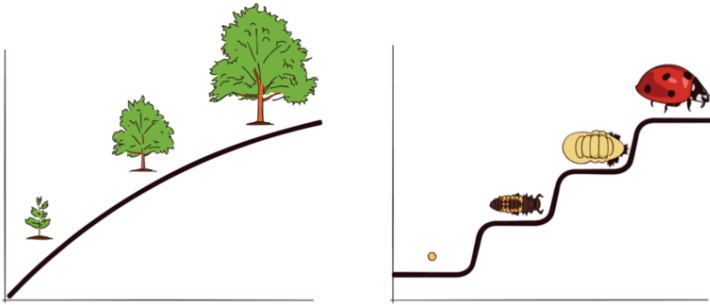


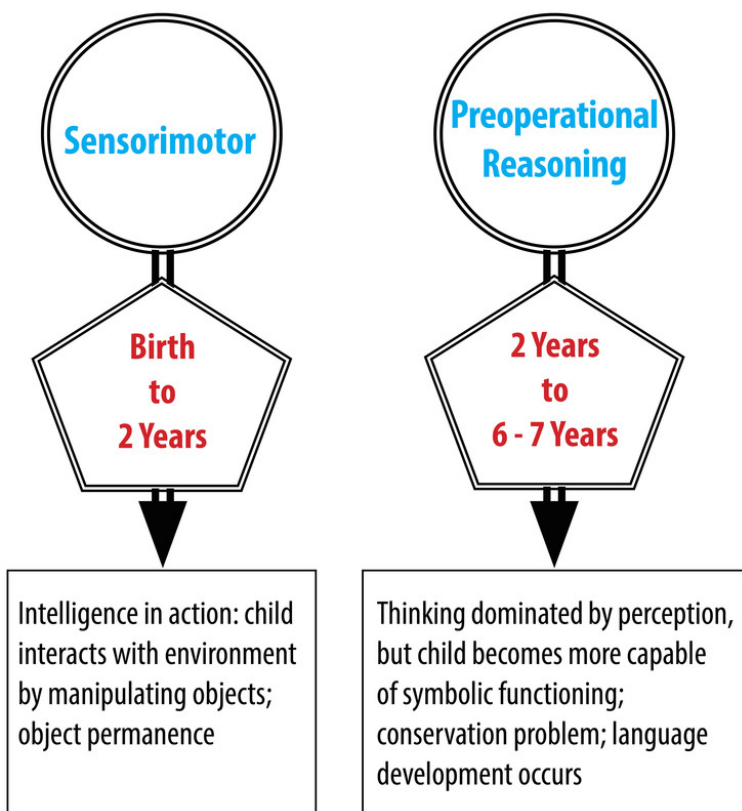
Figure 1: Continuous and discontinuous development. Some researchers see development as a continuous gradual process, much like a maple tree growing steadily in height and cross-sectional area. Other researchers see development as a progression of discontinuous stages, involving rapid discontinuous changes, such as those in the life cycle of a ladybug, separated by longer periods of slow, gradual change.

The great Swiss psychologist Jean Piaget proposed that children's thinking progresses through a series of four discrete stages. By "stages," he meant periods during which children reasoned similarly about many superficially different problems, with the stages occurring in a fixed order and the thinking within different stages differing in fundamental ways. The four stages that Piaget hypothesized were the **sensorimotor stage** (birth to 2 years), the **preoperational reasoning stage** (2 to 6 or 7 years), the **concrete operational reasoning stage** (6 or 7 to 11 or 12 years), and the **formal operational reasoning stage** (11 or 12 years and throughout the rest of life).

During the sensorimotor stage, children's thinking is largely realized through their perceptions of the world and their physical interactions with it. Their mental representations are very limited. Consider Piaget's **object permanence task**, which is one of his most famous problems. If an infant younger than 9 months of age is playing with a favorite toy, and another person removes the toy from view, for example by putting it under an

opaque cover and not letting the infant immediately reach for it, the infant is very likely to make no effort to retrieve it and to show no emotional distress (**Piaget, 1954**). This is not due to their being uninterested in the toy or unable to reach for it; if the same toy is put under a clear cover, infants below 9 months readily retrieve it (**Munakata, McClelland, Johnson, & Siegler, 1997**). Instead, Piaget claimed that infants less than 9 months do not understand that objects continue to exist even when out of sight.

During the preoperational stage, according to Piaget, children can solve not only this simple problem (which they actually can solve after 9 months) but show a wide variety of other symbolic-representation capabilities, such as those involved in drawing and using language. However, such 2- to 7-year-olds tend to focus on a single dimension, even when solving problems would require them to consider multiple dimensions. This is evident in Piaget's (1952) **conservation problems**. For example, if a glass of water is poured into a taller, thinner glass, children below age 7 generally say that there now is more water than before. Similarly, if a clay ball is reshaped into a long, thin sausage, they claim that there is now more clay, and if a row of coins is spread out, they claim that there are now more coins. In all cases, the children are focusing on one dimension, while ignoring the changes in other dimensions (for example, the greater width of the glass and the clay ball).



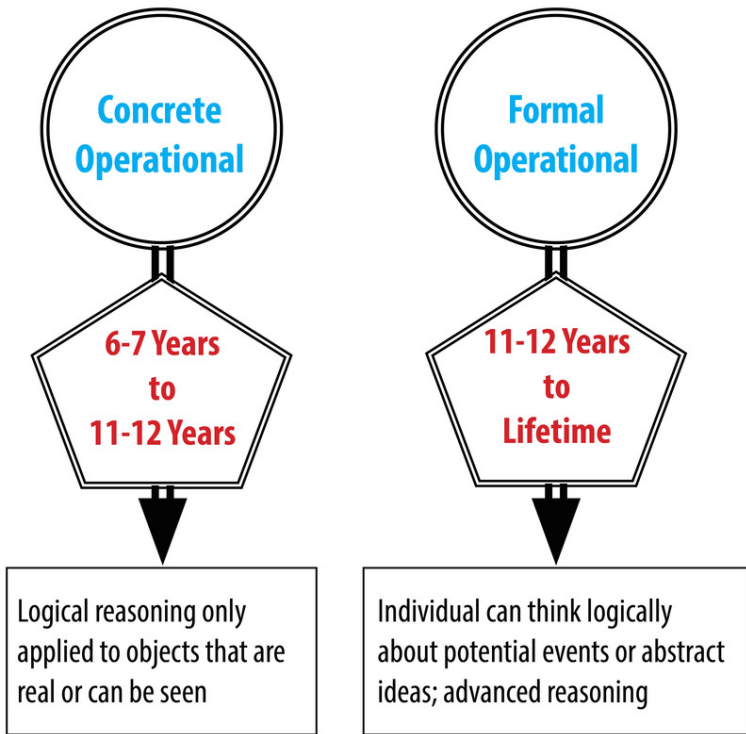
Piaget's Sensorimotor and Pre-operational Reasoning stages

Children overcome this tendency to focus on a single dimension during the **concrete operations stage**, and think logically in most situations. However, according to Piaget, they still cannot think in systematic scientific ways, even when such thinking would be useful. Thus, if asked to find out which variables influence the period that a pendulum takes to complete its arc, and given weights that they can attach to strings in order to do experiments with the pendulum to find out, most children younger than age 12, perform biased

experiments from which no conclusion can be drawn, and then conclude that whatever they originally believed is correct. For example, if a boy believed that weight was the only variable that mattered, he might put the heaviest weight on the shortest string and push it the hardest, and then conclude that just as he thought, weight is the only variable that matters (**Inhelder & Piaget, 1958**).

Finally, in the formal operations period, children attain the reasoning power of mature adults, which allows them to solve the pendulum problem and a wide range of other problems. However, this **formal operations stage** tends not to occur without exposure to formal education in scientific reasoning, and appears to be largely or completely absent from some societies that do not provide this type of education.

Although Piaget's theory has been very influential, it has not gone unchallenged. Many more recent researchers have obtained findings indicating that cognitive development is considerably more continuous than Piaget claimed. For example, Diamond (**1985**) found that on the object permanence task described above, infants show earlier knowledge if the waiting period is shorter. At age 6 months, they retrieve the hidden object if the wait is no longer than 2 seconds; at 7 months, they retrieve it if the wait is no longer than 4 seconds; and so on. Even earlier, at 3 or 4 months, infants show surprise in the form of longer looking times if objects suddenly appear to vanish with no obvious cause (**Baillargeon, 1987**). Similarly, children's specific experiences can greatly influence when developmental changes occur. Children of pottery makers in Mexican villages, for example, know that reshaping clay does not change the amount of clay at much younger ages than children who do not have similar experiences (**Price-Williams, Gordon, & Ramirez, 1969**).



Piaget's Concrete and Formal Operations stages

So, is cognitive development fundamentally continuous or fundamentally discontinuous? A reasonable answer seems to be, "It depends on how you look at it and how often you look." For example, under relatively facilitative circumstances, infants show early forms of object permanence by 3 or 4 months, and they gradually extend the range of times for which they can remember hidden objects as they grow older. However, on Piaget's original object permanence task, infants do quite quickly change toward the end of their first year from not reaching for hidden toys to reaching for them, even after they've experienced a substantial delay before being allowed

to reach. Thus, the debate between those who emphasize discontinuous, stage-like changes in cognitive development and those who emphasize gradual continuous changes remains a lively one.

Applications to Education

Understanding how children think and learn has proven useful for improving education. One example comes from the area of reading. Cognitive developmental research has shown that **phonemic awareness**—that is, awareness of the component sounds within words—is a crucial skill in learning to read. To measure awareness of the component sounds within words, researchers ask children to decide whether two words rhyme, to decide whether the words start with the same sound, to identify the component sounds within words, and to indicate what would be left if a given sound were removed from a word. Kindergartners' performance on these tasks is the strongest predictor of reading achievement in third and fourth grade, even stronger than IQ or social class background (**Nation, 2008**). Moreover, teaching these skills to randomly chosen 4- and 5-year-olds results in their being better readers years later (**National Reading Panel, 2000**).



Activities like playing games that involve working with numbers and spatial relationships can give young children a developmental advantage over peers who have less exposure to the same concepts. [Image: Ben Husmann, <https://goo.gl/awOXSw>, CC BY 2.0, <https://goo.gl/9uSnqN>]

Another educational application of cognitive developmental research involves the area of mathematics. Even before they enter kindergarten, the mathematical knowledge of children from low-income backgrounds lags far behind that of children from more affluent backgrounds. Ramani and Siegler (2008) hypothesized that this difference is due to the children in middle- and upper-income families engaging more frequently in numerical activities, for

example playing numerical board games such as **Chutes and Ladders**. Chutes and Ladders is a game with a number in each square; children start at the number one and spin a spinner or throw a dice to determine how far to move their token. Playing this game seemed likely to teach children about numbers, because in it, larger numbers are associated with greater values on a variety of dimensions. In particular, the higher the number that a child's token reaches, the greater the distance the token will have traveled from the starting point, the greater the number of physical movements the child will have made in moving the token from one square to another, the greater the number of number-words the child will have said and heard, and the more time will have passed since the beginning of the game. These spatial, kinesthetic, verbal, and time-based cues provide a broad-based, multisensory foundation for knowledge of **numerical magnitudes** (the sizes of numbers), a type of

knowledge that is closely related to mathematics achievement test scores (**Booth & Siegler, 2006**).

Playing this numerical board game for roughly 1 hour, distributed over a 2-week period, improved low-income children's knowledge of numerical magnitudes, ability to read printed numbers, and skill at learning novel arithmetic problems. The gains lasted for months after the game-playing experience (**Ramani & Siegler, 2008; Siegler & Ramani, 2009**). An advantage of this type of educational intervention is that it has minimal if any cost—a parent could just draw a game on a piece of paper.

Understanding of cognitive development is advancing on many different fronts. One exciting area is linking changes in brain activity to changes in children's thinking (**Nelson et al., 2006**). Although many people believe that brain maturation is something that occurs before birth, the brain actually continues to change in large ways for many years thereafter. For example, a part of the brain called the prefrontal cortex, which is located at the front of the brain and is particularly involved with planning and flexible problem solving, continues to develop throughout adolescence (**Blakemore & Choudhury, 2006**). Such new research domains, as well as enduring issues such as nature and nurture, continuity and discontinuity, and how to apply cognitive development research to education, insure that cognitive development will continue to be an exciting area of research in the coming years.

Conclusion

Research into cognitive development has shown us that minds don't just form according to a uniform blueprint or innate intellect, but through a combination of influencing factors. For instance, if we want our kids to have a strong grasp of language we could concentrate on phonemic awareness early on. If we

want them to be good at math and science we could engage them in numerical games and activities early on. Perhaps most importantly, we no longer think of brains as empty vessels waiting to be filled up with knowledge but as adaptable organs that develop all the way through early adulthood.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Chutes and Ladders

A numerical board game that seems to be useful for building numerical knowledge.

Concrete operations stage

Piagetian stage between ages 7 and 12 when children can think logically about concrete situations but not engage in systematic scientific reasoning.

Conservation problems

Problems pioneered by Piaget in which physical transformation of an object or set of objects changes a perceptually salient dimension but not the quantity that is being asked about.

Continuous development

Ways in which development occurs in a gradual incremental manner, rather than through sudden jumps.

Depth perception

The ability to actively perceive the distance from oneself of objects in the environment.

Discontinuous development

Development that does not occur in a gradual incremental manner.

Formal operations stage

Piagetian stage starting at age 12 years and continuing for the rest of life, in which adolescents may gain the reasoning powers of educated adults.

Information processing theories

Theories that focus on describing the cognitive processes that underlie thinking at any one age and cognitive growth over time.

Nature

The genes that children bring with them to life and that influence all aspects of their development.

Numerical magnitudes

The sizes of numbers.

Nurture

The environments, starting with the womb, that influence all aspects of children's development.

Object permanence task

The Piagetian task in which infants below about 9 months of age fail to search for an object that is removed from their sight and, if not allowed to search immediately for the object, act as if they do not know that it continues to exist.

Phonemic awareness

Awareness of the component sounds within words.

Piaget's theory

Theory that development occurs through a sequence of discontinuous stages: the sensorimotor, preoperational, concrete operational, and formal operational stages.

Preoperational reasoning stage

Period within Piagetian theory from age 2 to 7 years, in which children can represent objects through drawing and language but cannot solve logical reasoning problems, such as the conservation problems.

Qualitative changes

Large, fundamental change, as when a caterpillar changes into a butterfly; stage theories such as Piaget's posit that each stage reflects qualitative change relative to previous stages.

Quantitative changes

Gradual, incremental change, as in the growth of a pine tree's girth.

Sensorimotor stage

Period within Piagetian theory from birth to age 2 years, during which children come to represent the enduring reality of objects.

Sociocultural theories

Theory founded in large part by Lev Vygotsky that emphasizes how other people and the attitudes, values, and beliefs of the surrounding culture influence children's development.

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38. Autism: Insights from the Study of the Social Brain

Original chapter by Kevin A. Pelphrey
adapted by the Queen's University
Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen’s Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

Autistic people can struggle with initiating, maintaining, and understanding social interactions. Social neuroscience is the study of the parts of the brain that support social interactions or the “social brain.” This module provides an overview of autism and focuses on understanding the social brain. Our increasing understanding of the social brain will allow us to better identify the genes associated with autism, and will help us to best support individuals. Because social brain systems emerge in infancy, social neuroscience can help us to understand autism even before the symptoms of autism are clearly present. This is a hopeful time because social brain systems remain malleable well into adulthood and thus open to creative new interventions that are informed by state-of-the-art science.

Learning Objectives

- Know the basic symptoms of autism.
- Distinguish components of the social brain and understand their differences in autism.
- Appreciate how social neuroscience may facilitate the diagnosis of, and supports for, autism.

A personal note from the PSYC100 Teaching Team:

In this course we generally use person-first language when talking about individuals. For example, you will notice the use of person-first language as we talk about mental health diagnoses. Person-first language is generally used to affirm the value of people more so than their label (e.g., person with schizophrenia, not a “schizophrenic”).

This week our content includes autism. Many advocates in the Autism community prefer **identity-first language** rather than person-first language (e.g., there is a preference for “Autistic” or “Autistic person” being preferred over “person with Autism”). This identity-first language is generally preferred in the Autism community because it recognizes the value and worth of Autistic people – that being Autistic has value. For more on this distinction you can check out a wonderful blog post by the Autistic Self Advocacy Network <https://autisticadvocacy.org/about-asan/identity-first-language/>

We are grateful to have a diverse student

population in PSYC100, and a diverse teaching staff. In a class this size, we want to make it explicit that we respect individuals (you and each other!), and we want to be intentional about recognizing that we each have preferred ways of being acknowledged. Because of this, and because preferred language varies, we use person-first language in this book to reaffirm our commitment to respecting the dignity of individuals. In this chapter, we you will see the use of “Autistic” which differs from our typical practice. This is for the reasons above.

We also want to highlight an important aspect related to language when talking about diagnoses: a diagnosis is not necessarily considered a burden. This means that it is important to avoid language such as “suffers from autism.” Developing a vocabulary that is inclusive and respects the dignity of individuals takes time, practice, and learning from mistakes. It’s okay to make mistakes, as long we are all open to feedback. We will gently guide you on language where you might choose other words, and we hope that you will do the same for us. This is a learning opportunity for us all to practice inclusivity, and we thank you for your dedication to making this an inclusive space.

Autism

Autism, sometimes referred to as Autism Spectrum Disorder (ASD) and/or Autism Spectrum Condition (ASC), is a developmental condition that usually emerges in the first three years and persists throughout the individual's life. Though the key symptoms of autism fall into three general categories (see below), each person with autism exhibits symptoms in these domains in different ways and to varying degrees. This *phenotypic heterogeneity* reflects the high degree of variability in the genes underlying autism (Geschwind & Levitt, 2007). Though we have identified genetic differences associated with individual cases of autism, each accounts for only a small number of the actual cases, suggesting that no single genetic cause will apply in the majority of people with autism. There is currently no biological test for autism.

Autism is in the category of *neurodevelopmental disorders*, which includes Intellectual Disabilities, Autism Spectrum Disorder, Attention-Deficit/Hyperactivity Disorder (ADHD), and Learning Disorders, among others. *Autism spectrum disorder* (ASD) is defined by the presence of profound difficulties in social interactions and communication combined with the presence of repetitive or restricted interests, cognitions and behaviors. The diagnostic process involves a combination of parental report and clinical observation. Children with significant impairments across the social/communication domain who also exhibit repetitive behaviors can qualify for a diagnosis of autism. There is wide variability in the precise symptom profile an individual may exhibit.

Control



Autism



Figure 1. The red lines indicate the scan paths (collection of eye movements) used by people with (right column) and without (left column) autism to explore faces. Modified from Pelphrey et al., (2002).

Since Kanner first described autism in 1943, important commonalities in symptom presentation have been used to compile criteria for the diagnosis of autism. These diagnostic criteria have evolved during the past 70 years and continue to evolve (e.g., see the recent changes to the diagnostic criteria on the American Psychiatric Association's website,

<http://www.dsm5.org/>), yet impaired social functioning remains a required symptom for an autism diagnosis. Difficulties in social functioning are present in

varying degrees for simple behaviors such as eye contact, and complex behaviors like navigating the give and take of a group conversation for individuals of all functioning levels (i.e. high or low IQ). Moreover, difficulties with social information processing occur in both visual (e.g., **Pelphrey et al., 2002**) and auditory (e.g., Dawson, Meltzoff, Osterling, Rinaldi, & Brown, **1998**) sensory modalities.

Consider the results of an eye tracking study in which Pelphrey and colleagues (**2002**) observed that Autistic individuals did not make use of the eyes when judging facial expressions of emotion (see right panels of Figure 1). While repetitive behaviors or language difficulties are seen in other disorders (e.g., obsessive-compulsive disorder and specific language impairment, respectively), the basic social difficulties of this nature are unique to autism. Onset of the social deficits

appears to precede difficulties in other domains (Osterling, Dawson, & Munson, **2002**) and may emerge as early as 6 months of age (Maestro et al., **2002**).

Defining the Social Brain

Within the past few decades, research has elucidated specific brain circuits that support perception of humans and other species. This *social perception* refers to “the initial stages in the processing of information that culminates in the accurate analysis of the dispositions and intentions of other individuals” (Allison, Puce, & McCarthy, **2000**). Basic social perception is a critical building block for more sophisticated social behaviors, such as thinking about the motives and emotions of others. Brothers (**1990**) first suggested the notion of a **social brain**, a set of interconnected neuroanatomical structures that process social information, enabling the recognition of other individuals and the evaluation their mental states (e.g., intentions, dispositions, desires, and beliefs).

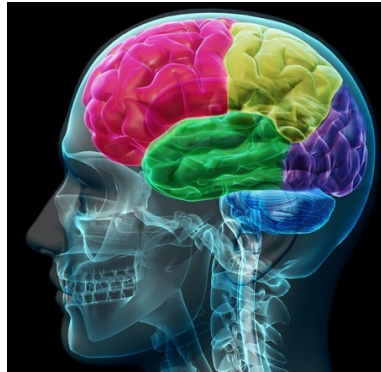
The social brain is hypothesized to consist of the amygdala, the orbital frontal cortex (OFC), fusiform gyrus (FG), and the posterior superior temporal sulcus (STS) region, among other structures. Though all areas work in coordination to support social processing, each appears to serve a distinct role. The amygdala helps us recognize the emotional states of others (e.g., Morris et al., **1996**) and also to experience and regulate our own emotions (e.g., LeDoux, **1992**). The OFC supports the “reward” feelings we have when we are around other people (e.g., Rolls, **2000**). The FG, located at the bottom of the surface of the temporal lobes detects faces and supports face recognition (e.g., Puce, Allison, Asgari, Gore, & McCarthy, **1996**). The posterior STS region recognizes the biological motion, including eye, hand and other body movements, and helps to

interpret and predict the actions and intentions of others (e.g., Pelphrey, Morris, Michelich, Allison, & McCarthy, 2005).

Current Understanding of Social Perception in Autism

The social brain is of great research interest because the social difficulties characteristic of autism are thought to relate closely to the functioning of this brain network.

Functional magnetic resonance imaging (fMRI) and **event-related potentials (ERP)** are complementary brain imaging methods used to study activity in the brain across the lifespan. Each method measures a distinct



The human brain has specialized functions to help guide our social interactions. [Image: Allan Ajifo, <https://goo.gl/jv4iXf>, CC BY 2.0, <https://goo.gl/BRvSA7>]

facet of brain activity and contributes unique information to our understanding of brain function.

fMRI uses powerful magnets to measure the levels of oxygen within the brain, which vary according to changes in neural activity. As the neurons in specific brain regions “work harder”, they require more oxygen. fMRI detects the brain regions that exhibit a relative increase in blood flow (and oxygen levels) while people listen to or view social stimuli in the MRI scanner. The areas of the brain most crucial for different social processes are thus identified, with spatial information being accurate to the millimeter.

In contrast, ERP provides direct measurements of the firing

of groups of neurons in the cortex. Non-invasive sensors on the scalp record the small electrical currents created by this neuronal activity while the subject views stimuli or listens to specific kinds of information. While fMRI provides information about *where* brain activity occurs, ERP specifies *when* by detailing the timing of processing at the millisecond pace at which it unfolds.

ERP and fMRI are complementary, with fMRI providing excellent *spatial resolution* and ERP offering outstanding *temporal resolution*. Together, this information is critical to understanding the nature of social perception in autism. To date, the most thoroughly investigated areas of the social brain in autism are the superior temporal sulcus (STS), which underlies the perception and interpretation of biological motion, and the fusiform gyrus (FG), which supports face perception. Heightened sensitivity to biological motion (for humans, motion such as walking) serves an essential role in the development of humans and other highly social species. Emerging in the first days of life, the ability to detect biological motion helps to orient vulnerable young to critical sources of sustenance, support, and learning, and develops independent of visual experience with biological motion (e.g., **Simion, Regolin, & Bulf, 2008**). This inborn “life detector” serves as a foundation for the subsequent development of more complex social behaviors (**Johnson, 2006**).



From an evolutionary standpoint, it was incredibly important for our survival to maintain social relationships. Therefore, it makes sense that we would be able to recognize faces within the first few days of our infancy. [Image: donnierayjones, <https://goo.gl/obr12x>, CC BY 2.0, <https://goo.gl/v4Y0ZV>]

From very early in life, children with autism display reduced sensitivity to biological motion (Klin, Lin, Gorrindo, Ramsay, & Jones, 2009). Individuals with autism have reduced activity in the STS during biological motion perception. Similarly, people at increased genetic risk for autism but who do not develop symptoms of the disorder (i.e., unaffected siblings of individuals with autism) show increased activity in this region, which is hypothesized to be a compensatory mechanism to offset genetic vulnerability

(Kaiser et al., 2010).

In neurotypical development, preferential attention to faces and the ability to recognize individual faces emerge in the first days of life (e.g., Goren, Sarty, & Wu, 1975). The special way in which the brain responds to faces usually emerges by three months of age (e.g., de Haan, Johnson, & Halit, 2003) and continues throughout the lifespan (e.g., Bentin et al., 1996). Autistic children, however, tend to show decreased attention to human faces by six to 12 months (Osterling & Dawson, 1994). Autistic children also show reduced activity in the FG when viewing faces (e.g., Schultz et al., 2000). Slowed processing of faces (McPartland, Dawson, Webb, Panagiotides, & Carver, 2004) is a characteristic of Autistic people that is shared by parents of children with autism (Dawson, Webb, & McPartland, 2005) and infants at increased risk for developing autism because of having a sibling with autism (McCleery, Akshoomoff,

Dobkins, & Carver, 2009). Behavioral and attentional differences in face perception and recognition are evident in Autistic children and adults as well (e.g., Hobson, 1986).

Exploring Diversity in Autism

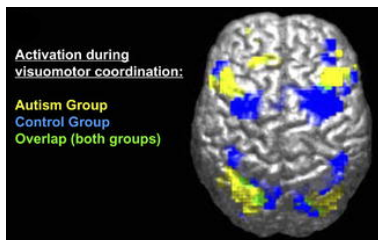
Because of the limited quality of the behavioral methods used to diagnose autism and current clinical diagnostic practice, which permits similar diagnoses despite distinct symptom profiles (McPartland, Webb, Keehn, & Dawson, 2011), it is possible that the group of children currently referred to as having autism may actually represent different syndromes with distinct causes. Examination of the social brain may well reveal diagnostically meaningful subgroups of Autistic children. Measurements of the “where” and “when” of brain activity during social processing tasks provide reliable sources of the detailed information needed to profile Autistic children with greater accuracy. These profiles, in turn, may help to inform the development of supports by helping us to match specific supports to specific profiles.

The integration of imaging methods is critical for this endeavor. Using face perception as an example, the combination of fMRI and ERP could identify who, of those Autistic individuals, shows anomalies in the FG and then determine the stage of information processing at which these anomalies occur. Because different processing stages often reflect discrete cognitive processes, this level of understanding could encourage supports that address specific processing differences at the neural level.

For example, differences observed in the early processing stages might reflect problems with low-level visual perception, while later differences would indicate problems with higher-order processes, such as emotion recognition. These same principles can be applied to the broader network of social brain

regions and, combined with measures of behavioral functioning, could offer a comprehensive profile of brain-behavior performance for a given individual. A fundamental goal for this kind of subgroup approach is to improve the ability to tailor supports to the individual.

Another objective is to improve the power of other scientific tools. Most studies of Autistic individuals compare groups of individuals, for example, Autistic individuals compared to neurotypically developing peers. However, studies have also attempted to compare children by behavioral or cognitive characteristics (e.g., cognitively able versus developmentally delayed or anxious versus non-anxious).



Trying to diagnose the precise autism disorder can be difficult; many cases share similar symptoms. However, burgeoning technology, like the fMRI, allows clinicians a glimpse into the patient's brain and thus a better understanding of his or her disorder. [Image: Ralph-Axel Müller, <https://goo.gl/WwxCVI>, CC BY 2.5, <https://goo.gl/0QtWcf>]

Yet, the power of a scientific study to detect these kinds of significant, meaningful, individual differences is only as strong as the accuracy of the factor used to define the compared groups.

The identification of distinct subgroups within autism according to information about the brain would allow for a more accurate and detailed exposition of the individual differences seen in Autistic people. This is especially critical for the success of investigations into the genetic basis of autism. As mentioned before, the genes discovered thus far account for only a small portion of autism cases. If meaningful, quantitative distinctions in Autistic individuals are identified; a more focused examination into the genetic causes specific to each subgroup could then be pursued. Moreover, distinct findings

from neuroimaging, or *biomarkers*, can help guide genetic research. **Endophenotypes**, or characteristics that are not immediately available to observation but that reflect an underlying genetic potential, expose the most basic components of a complex psychiatric condition and are more stable across the lifespan than observable behavior (Gottesman & Shields, 1973). By describing the key characteristics of autism in these objective ways, neuroimaging research will facilitate identification of genetic contributions to autism.

Brain Development and Behaviour

Because autism is a developmental condition, it is particularly important to detect and understand the effects of autism early in life. Early differences in attention to biological motion, for instance, can hinder subsequent experiences in attending to higher level social information, thereby driving development toward more severe difficulties and stimulating struggles in additional domains of functioning, such as language development. Without early predictors of function, and in the absence of a firm diagnosis until behavioral symptoms emerge, supports are often delayed for two or more years, eclipsing a crucial period in which intervention may be particularly successful in ameliorating some of the social and communicative difficulties seen in autism.

In response to the great need for sensitive (able to identify subtle cases) and specific (able to distinguish autism from other disorders) early indicators of autism, such as biomarkers, many research groups from around the world have been studying patterns of infant development using prospective longitudinal studies of infant siblings of Autistic children and a comparison group of infant siblings without familial risks. Such designs gather longitudinal information about developmental

trajectories across the first three years of life for both groups followed by clinical diagnosis at approximately 36 months.



If autism is diagnosed early enough, supports have developed to the point Autistic children can learn and grow to have more enjoyable social interactions.

[Image: hepington, <https://goo.gl/TloAcY>, CC BY-SA 2.0, <https://goo.gl/rxiUsF>]

These studies are problematic in that many of the social features of autism do not emerge in development until after 12 months of age, and it is not certain that these symptoms will manifest during the limited periods of observation involved in clinical evaluations or in pediatricians' offices. Moreover, across development, but especially during infancy, behavior is widely variable and often

unreliable, and at present, behavioral observation is the only means to detect symptoms of autism and to confirm a diagnosis. This is quite problematic because, even highly sophisticated behavioral methods, such as eye tracking (see Figure 1), do not necessarily reveal reliable differences in Autistic infants (**Ozonoff et al., 2010**). However, measuring the brain activity associated with social perception can detect differences that do not appear in behavior until much later. The identification of biomarkers utilizing the imaging methods we have described offers promise for earlier detection of atypical social development.

ERP measures of brain response predict subsequent development of autism in infants as young as six months old who showed neurotypical patterns of visual fixation (as measured by eye tracking) (**Elsabbagh et al., 2012**). This suggests the great promise of brain imaging for earlier recognition of autism.

Hope for Improved Outcomes

The brain imaging research described above offers hope for the future of supports for autism. Many of the functions of the social brain demonstrate significant *plasticity*, meaning that their functioning can be affected by experience over time. In contrast to theories that suggest difficulty processing complex information or communicating across large expanses of cortex (**Minshew & Williams, 2007**), this malleability of the social brain is a positive prognosticator for the development of supports. Given the observed plasticity of the social brain, supporting those experiencing difficulties may be possible with appropriate and timely intervention.

The social environment in which a person lives, especially social support from parents, friends, and instructors, can have a positive impact on the lives of Autistic people. For example, the social environment of a job can positively impact their social development (Taylor et al, 2014). Similarly, research often reveals that it is not the symptoms of autism itself that interferes with a person's wellbeing, but the bullying, stigma, and concealment of symptoms that sometimes accompanies autism (Hong et al, 2016). Taken together, these lines of research suggest that supportive social environments are crucial for the wellbeing of those with autism.

It should be noted that many Autistic individuals have expressed concern that approaches focused on “treatment” for autism is trying to erase Autistic children's unique personalities and strengths. Some advocate for the idea that Autistic people do not need “treatment,” rather it is the world that needs to change to accommodate Autistic people. Indeed, every effort should be made to build inclusive environments, and eliminate stigma about autism. Additionally, supporting individuals at a young age is important for the development of skills such as language and some social understanding.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Endophenotypes

A characteristic that reflects a genetic liability for disease and a more basic component of a complex clinical presentation. Endophenotypes are less developmentally malleable than overt behavior.

Event-related potentials (ERP)

Measures the firing of groups of neurons in the cortex. As a person views or listens to specific types of information, neuronal activity creates small electrical currents that can be recorded from non-invasive sensors placed on the scalp. ERP provides excellent information about the timing of processing, clarifying brain activity at the millisecond pace at which it unfolds.

Functional magnetic resonance imaging (fMRI)

Entails the use of powerful magnets to measure the levels of oxygen within the brain that vary with changes in neural activity. That is, as the neurons in specific brain regions “work harder” when performing a specific task, they require more oxygen. By having people listen to or view social percepts in an MRI scanner, fMRI specifies the brain regions that evidence a relative increase in blood flow. In this way, fMRI provides excellent spatial information, pinpointing with millimeter accuracy, the brain regions most critical for different social processes.

Social brain

The set of neuroanatomical structures that allows us to understand the actions and intentions of other people.

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PSYC 100 XIV

SOCIAL AND EMOTIONAL DEVELOPMENT

39. Social and Personality Development in Childhood

Original chapter by Kevin A. Pelphrey
adapted by the Queen's University
Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen’s Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

Childhood social and personality development emerges through the interaction of social influences, biological maturation, and the child’s representations of the social world and the self. This interaction is illustrated in a discussion of the influence of significant relationships, the development of social understanding, the growth of personality, and the development of social and emotional competence in childhood.

Learning Objectives

- Provide specific examples of how the interaction of social experience, biological maturation, and the child's representations of experience and the self provide the basis for growth in social and personality development.
- Describe the significant contributions of parent-child and peer relationships to the development of social skills and personality in childhood.
- Explain how achievements in social understanding occur in childhood. Moreover, do scientists believe that infants and young children are egocentric?
- Describe the association of temperament with personality development.
- Explain what is "social and emotional competence" and provide some examples of how it develops in childhood.

Introduction

"How have I become the kind of person I am today?" Every adult ponders this question from time to time. The answers that readily come to mind include the influences of parents, peers, temperament, a moral compass, a strong sense of self, and sometimes critical life experiences such as parental divorce. Social and personality development encompasses these and many other influences on the growth of the person. In addition, it addresses questions that are at the heart of understanding how we develop as unique people. How much are we products of nature or nurture? How enduring are the influences of early experiences? The study of social and personality development offers perspective on these and other issues, often by showing how complex and multifaceted are the influences on developing children, and thus the intricate

processes that have made you the person you are today (Thompson, 2006a).

Understanding social and personality development requires looking at children from three perspectives that interact to shape development. The first is the social context in which each child lives, especially the relationships that provide security, guidance, and knowledge. The second is biological maturation that supports developing social and emotional competencies and underlies temperamental individuality.



Humans are inherently social creatures. Mostly, we work, play, and live together in groups.

[Image: The Daring Librarian, <https://goo.gl/LmA2pS>, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

The third is children's developing representations of themselves and the social world. Social and personality development is best understood as the continuous interaction between these social, biological, and representational aspects of psychological development.

Relationships

This interaction can be observed in the development of the earliest relationships between infants and their parents in the first year. Virtually all infants living in normal circumstances develop strong emotional attachments to those who care for them. Psychologists believe that the development of these attachments is as biologically natural as learning to walk and not simply a byproduct of the parents' provision of food or warmth. Rather, attachments have evolved in humans because

they promote children's motivation to stay close to those who care for them and, as a consequence, to benefit from the learning, security, guidance, warmth, and affirmation that close relationships provide (**Cassidy, 2008**).



One of the first and most important relationships is between mothers and infants. The quality of this relationship has an effect on later psychological and social development. [Image: Premnath Thirumalaisamy, <https://goo.gl/66BROf>, CC BY-NC 2.0, <https://goo.gl/Fllc2e>]

Although nearly all infants develop emotional attachments to their caregivers—parents, relatives, nannies—their sense of security in those attachments varies. Infants become *securely* attached when their parents respond sensitively to them, reinforcing the infants' confidence that their parents will provide support when needed. Infants become *insecurely* attached when care is inconsistent or neglectful; these infants tend to respond avoidantly,

resistantly, or in a disorganized manner (**Belsky & Pasco Fearon, 2008**). Such insecure attachments are not necessarily the result of deliberately bad parenting but are often a byproduct of circumstances. For example, an overworked single mother may find herself overstressed and fatigued at the end of the day, making fully-involved childcare very difficult. In other cases, some parents are simply poorly emotionally equipped to take on the responsibility of caring for a child.

The different behaviors of securely- and insecurely-attached infants can be observed especially when the infant needs the caregiver's support. To assess the nature of attachment, researchers use a standard laboratory procedure called the

“Strange Situation,” which involves brief separations from the caregiver (e.g., mother) (Solomon & George, 2008). In the Strange Situation, the caregiver is instructed to leave the child to play alone in a room for a short time, then return and greet the child while researchers observe the child’s response. Depending on the child’s level of attachment, he or she may reject the parent, cling to the parent, or simply welcome the parent—or, in some instances, react with an agitated combination of responses.

Infants can be securely or insecurely attached with mothers, fathers, and other regular caregivers, and they can differ in their security with different people. The **security of attachment** is an important cornerstone of social and personality development, because infants and young children who are securely attached have been found to develop stronger friendships with peers, more advanced emotional understanding and early conscience development, and more positive self-concepts, compared with insecurely attached children (Thompson, 2008). This is consistent with attachment theory’s premise that experiences of care, resulting in secure or insecure attachments, shape young children’s developing concepts of the self, as well as what people are like, and how to interact with them.

As children mature, parent-child relationships naturally change. Preschool and grade-school children are more capable, have their own preferences, and sometimes refuse or seek to compromise with parental expectations. This can lead to greater parent-child conflict, and how conflict is managed by parents further shapes the quality of parent-child relationships. In general, children develop greater competence and self-confidence when parents have high (but reasonable) expectations for children’s behavior, communicate well with them, are warm and responsive, and use reasoning (rather than coercion) as preferred responses to children’s misbehavior. This kind of parenting style has been described

as **authoritative** (Baumrind, 2013). Authoritative parents are supportive and show interest in their kids' activities but are not overbearing and allow them to make constructive mistakes. By contrast, some less-constructive parent-child relationships result from authoritarian, uninvolved, or permissive parenting styles (see Table 1).

Expectations/Control			
Warmth/ Responsiveness	Low		High
	Low	uninvolved	authoritarian
		permissive	authoritative
	High		

Table 1: Comparison of Four Parenting Styles

Parental roles in relation to their children change in other ways, too. Parents increasingly become mediators (or gatekeepers) of their children's involvement with peers and activities outside the family. Their communication and practice of values contributes to children's academic achievement, moral development, and activity preferences. As children reach adolescence, the parent-child relationship increasingly becomes one of "coregulation," in which both the parent(s) and the child recognizes the child's growing competence and autonomy, and together they rebalance authority relations. We often see evidence of this as parents start accommodating their teenage kids' sense of independence by allowing them to get cars, jobs, attend parties, and stay out later.

Family relationships are significantly affected by conditions outside the home. For instance, the **Family Stress**

Model describes how financial difficulties are associated with parents' depressed moods, which in turn lead to marital problems and poor parenting that contributes to poorer child adjustment (**Conger, Conger, & Martin, 2010**). Within the home, parental marital difficulty or divorce affects more than half the children growing up today in the United States. Divorce is typically associated with economic stresses for children and parents, the renegotiation of parent-child relationships (with one parent typically as primary custodian and the other assuming a visiting relationship), and many other significant adjustments for children. Divorce is often regarded by children as a sad turning point in their lives, although for most it is not associated with long-term problems of adjustment (**Emery, 1999**).

Peer Relationships

Parent-child relationships are not the only significant relationships in a child's life. Peer relationships are also important. Social interaction with another child who is similar in age, skills, and knowledge provokes the development of many social skills that are valuable for the rest of life (**Bukowski, Buhrmester, & Underwood, 2011**). In peer relationships, children learn how to initiate and maintain social interactions with other children. They learn skills for



Peer relationships are particularly important for children. They can be supportive but also challenging. Peer rejection may lead to behavioral problems later in life. [Image: Twentyfour Students, <https://goo.gl/3IS2gV>, CC BY-SA 2.0, <https://goo.gl/jSSrcO>]

managing conflict, such as turn-taking, compromise, and bargaining. Play also involves the mutual, sometimes complex, coordination of goals, actions, and understanding. For example, as infants, children get their first encounter with sharing (of each other's toys); during pretend play as preschoolers they create narratives together, choose roles, and collaborate to act out their stories; and in primary school, they may join a sports team, learning to work together and support each other emotionally and strategically toward a common goal. Through these experiences, children develop friendships that provide additional sources of security and support to those provided by their parents.

However, peer relationships can be challenging as well as supportive (**Rubin, Coplan, Chen, Bowker, & McDonald, 2011**). Being accepted by other children is an important source of affirmation and self-esteem, but peer rejection can foreshadow later behavior problems (especially when children are rejected due to aggressive behavior). With increasing age, children confront the challenges of bullying, peer victimization, and managing conformity pressures. Social comparison with peers is an important means by which children evaluate their skills, knowledge, and personal qualities, but it may cause them to feel that they do not measure up well against others. For example, a boy who is not athletic may feel unworthy of his football-playing peers and revert to shy behavior, isolating himself and avoiding conversation. Conversely, an athlete who doesn't "get" Shakespeare may feel embarrassed and avoid reading altogether. Also, with the approach of adolescence, peer relationships become focused on psychological intimacy, involving personal disclosure, vulnerability, and loyalty (or its betrayal)—which significantly affects a child's outlook on the world. Each of these aspects of peer relationships requires developing very different social and emotional skills than those that emerge in parent-child relationships. They also illustrate

the many ways that peer relationships influence the growth of personality and self-concept.

Social Understanding

As we have seen, children's experience of relationships at home and the peer group contributes to an expanding repertoire of social and emotional skills and also to broadened social understanding. In these relationships, children develop expectations for specific people (leading, for example, to secure or insecure attachments to parents), understanding of how to interact with adults and peers, and developing self-concept based on how others respond to them. These relationships are also significant forums for emotional development.

Remarkably, young children begin developing social understanding very early in life. Before the end of the first year, infants are aware that other people have perceptions, feelings, and other mental states that affect their behavior, and which are different from the child's own mental states. This can be readily observed in a process called **social referencing**, in which an infant looks to the mother's face when confronted with an unfamiliar person or situation (**Feinman, 1992**). If the mother looks calm and reassuring, the infant responds positively as if the situation is safe. If the mother looks fearful or distressed, the infant is likely to respond with wariness or distress because the mother's expression signals danger. In a remarkably insightful manner, therefore, infants show an awareness that even though they are uncertain about the unfamiliar situation, their mother is not, and that by "reading" the emotion in her face, infants can learn about whether the circumstance is safe or dangerous, and how to respond.

Although developmental scientists used to believe that infants are egocentric—that is, focused on their own perceptions and experience—they now realize that the

opposite is true. Infants are aware at an early stage that people have different mental states, and this motivates them to try to figure out what others are feeling, intending, wanting, and thinking, and how these mental states affect their behavior. They are beginning, in other words, to develop a **theory of mind**, and although their understanding of mental states begins very simply, it rapidly expands (**Wellman, 2011**). For example, if an 18-month-old watches an adult try repeatedly to drop a necklace into a cup but inexplicably fail each time, they will immediately put the necklace into the cup themselves—thus completing what the adult intended, but failed, to do. In doing so, they reveal their awareness of the intentions underlying the adult's behavior (**Meltzoff, 1995**). Carefully designed experimental studies show that by late in the preschool years, young children understand that another's beliefs can be mistaken rather than correct, that memories can affect how you feel, and that one's emotions can be hidden from others (**Wellman, 2011**). Social understanding grows significantly as children's theory of mind develops.

How do these achievements in social understanding occur? One answer is that young children are remarkably sensitive observers of other people, making connections between their emotional expressions, words, and behavior to derive simple inferences about mental states (e.g., concluding, for example, that what Mommy is looking at is in her mind) (**Gopnik, Meltzoff, & Kuhl, 2001**). This is especially likely to occur in relationships with people whom the child knows well, consistent with the ideas of attachment theory discussed above. Growing language skills give young children words with which to represent these mental states (e.g., “mad,” “wants”) and talk about them with others. Thus in conversation with their parents about everyday experiences, children learn much about people's mental states from how adults talk about them (“Your sister was sad because she thought Daddy was coming home.”) (**Thompson, 2006b**). Developing social understanding

is, in other words, based on children's everyday interactions with others and their careful interpretations of what they see and hear. There are also some scientists who believe that infants are biologically prepared to perceive people in a special way, as organisms with an internal mental life, and this facilitates their interpretation of people's behavior with reference to those mental states (Leslie, 1994).

Personality



Although a child's temperament is partly determined by genetics, environmental influences also contribute to shaping personality. Positive personality development is supported by a "good fit" between a child's natural temperament, environment and experiences. [Image: Thomas Hawk, <https://goo.gl/2So40O>, CC BY-NC 2.0, <https://goo.gl/Fllc2e>]

Parents look into the faces of their newborn infants and wonder, "What kind of person will this child will become?" They scrutinize their baby's preferences, characteristics, and responses for clues of a developing personality. They are quite right to do so, because temperament is a foundation for personality growth.

But **temperament** (defined as early-emerging differences in reactivity and self-regulation) is not the whole story. Although temperament is biologically

based, it interacts with the influence of experience from the moment of birth (if not before) to shape personality (Rothbart, 2011). Temperamental dispositions are affected, for example, by the support level of parental care. More generally, personality is shaped by the **goodness of fit** between the child's

temperamental qualities and characteristics of the environment (**Chess & Thomas, 1999**). For example, an adventurous child whose parents regularly take her on weekend hiking and fishing trips would be a good “fit” to her lifestyle, supporting personality growth. Personality is the result, therefore, of the continuous interplay between biological disposition and experience, as is true for many other aspects of social and personality development.

Personality develops from temperament in other ways (**Thompson, Winer, & Goodvin, 2010**). As children mature biologically, temperamental characteristics emerge and change over time. A newborn is not capable of much self-control, but as brain-based capacities for self-control advance, temperamental changes in self-regulation become more apparent. For example, a newborn who cries frequently doesn’t necessarily have a grumpy personality; over time, with sufficient parental support and increased sense of security, the child might be less likely to cry.

In addition, personality is made up of many other features besides temperament. Children’s developing self-concept, their motivations to achieve or to socialize, their values and goals, their coping styles, their sense of responsibility and conscientiousness, and many other qualities are encompassed into personality. These qualities are influenced by biological dispositions, but even more by the child’s experiences with others, particularly in close relationships, that guide the growth of individual characteristics.

Indeed, personality development begins with the biological foundations of temperament but becomes increasingly elaborated, extended, and refined over time. The newborn that parents gazed upon thus becomes an adult with a personality of depth and nuance.

Social and Emotional Competence

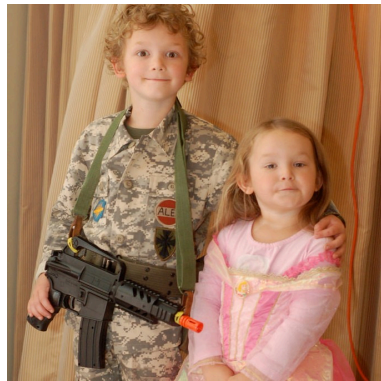
Social and personality development is built from the social, biological, and representational influences discussed above. These influences result in important developmental outcomes that matter to children, parents, and society: a young adult's capacity to engage in socially constructive actions (helping, caring, sharing with others), to curb hostile or aggressive impulses, to live according to meaningful moral values, to develop a healthy identity and sense of self, and to develop talents and achieve success in using them. These are some of the developmental outcomes that denote social and emotional competence.

These achievements of social and personality development derive from the interaction of many social, biological, and representational influences. Consider, for example, the development of conscience, which is an early foundation for moral development. **Conscience** consists of the cognitive, emotional, and social influences that cause young children to create and act consistently with internal standards of conduct (Kochanska, 2002). Conscience emerges from young children's experiences with parents, particularly in the development of a mutually responsive relationship that motivates young children to respond constructively to the parents' requests and expectations. Biologically based temperament is involved, as some children are temperamentally more capable of motivated self-regulation (a quality called **effortful control**) than are others, while some children are dispositionally more prone to the fear and anxiety that parental disapproval can evoke. Conscience development grows through a good fit between the child's temperamental qualities and how parents communicate and reinforce behavioral expectations. Moreover, as an illustration of the interaction of genes and experience, one research group found that young children with a particular gene allele (the 5-HTTLPR) were low on measures of

conscience development when they had previously experienced unresponsive maternal care, but children with the same allele growing up with responsive care showed strong later performance on conscience measures (**Kochanska, Kim, Barry, & Philibert, 2011**).

Conscience development also expands as young children begin to represent moral values and think of themselves as moral beings. By the end of the preschool years, for example, young children develop a “moral self” by which they think of themselves as people who want to do the right thing, who feel badly after misbehaving, and who feel uncomfortable when others misbehave. In the development of conscience, young children become more socially and emotionally competent in a manner that provides a foundation for later moral conduct (**Thompson, 2012**).

The development of gender and gender identity is likewise an interaction among social, biological, and representational influences (Ruble, Martin, & Berenbaum, **2006**). Young children learn about gender from parents, peers, and others in society, and develop their own conceptions of the attributes associated with maleness or femaleness (called **gender schemas**). They also negotiate biological transitions (such as puberty) that cause their sense of themselves and their sexual identity to mature.



Social influences such as cultural norms impact children's interests, dress, style of speech and even life aspirations. [Image: Amanda Westmont, <https://goo.gl/ntS5qx>, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

Each of these examples of the growth of social and emotional competence illustrates not only the interaction of social,

biological, and representational influences, but also how their development unfolds over an extended period. Early influences are important, but not determinative, because the capabilities required for mature moral conduct, gender identity, and other outcomes continue to develop throughout childhood, adolescence, and even the adult years.

The Study of Pro-Social and Bullying Behaviours at Queen's University

Dr. Wendy Craig and Dr. Valerie Kuhlmeier are psychological scientists at Queen's who are exploring connections between pro-social and bullying behaviours. In this video, they share insights into their research in this area.



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Conclusion

As the preceding sentence suggests, social and personality development continues through adolescence and the adult years, and it is influenced by the same constellation of social, biological, and representational influences discussed for

childhood. Changing social relationships and roles, biological maturation and (much later) decline, and how the individual represents experience and the self continue to form the bases for development throughout life. In this respect, when an adult looks forward rather than retrospectively to ask, “what kind of person am I becoming?”—a similarly fascinating, complex, multifaceted interaction of developmental processes lies ahead.

Check Your Knowledge

To help you with your studying, we’ve included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Authoritative

A parenting style characterized by high (but reasonable) expectations for children's behavior, good communication, warmth and nurturance, and the use of reasoning (rather

than coercion) as preferred responses to children's misbehavior.

Conscience

The cognitive, emotional, and social influences that cause young children to create and act consistently with internal standards of conduct.

Effortful control

A temperament quality that enables children to be more successful in motivated self-regulation.

Family Stress Model

A description of the negative effects of family financial difficulty on child adjustment through the effects of economic stress on parents' depressed mood, increased marital problems, and poor parenting.

Gender schemas

Organized beliefs and expectations about maleness and femaleness that guide children's thinking about gender.

Goodness of fit

The match or synchrony between a child's temperament and characteristics of parental care that contributes to positive or negative personality development. A good "fit" means that parents have accommodated to the child's temperamental attributes, and this contributes to positive personality growth and better adjustment.

Security of attachment

An infant's confidence in the sensitivity and responsiveness of a caregiver, especially when he or she is needed. Infants can be securely attached or insecurely attached.

Social referencing

The process by which one individual consults another's

emotional expressions to determine how to evaluate and respond to circumstances that are ambiguous or uncertain.

Temperament

Early emerging differences in reactivity and self-regulation, which constitutes a foundation for personality development.

Theory of mind

Children's growing understanding of the mental states that affect people's behavior.

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40. Attachment Through the Life Course

Original chapter by R. Chris Fraley adapted by the Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below. We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link:
<https://sass.queensu.ca/psyc100/>

The purpose of this module is to provide a brief review of attachment theory—a theory designed to explain the significance of the close, emotional bonds that children develop with their caregivers and the implications of those bonds for understanding personality development. The module discusses the origins of the theory, research on individual differences in attachment security in infancy and childhood, and the role of attachment in adult relationships.

Learning Objectives

- Explain the way the attachment system works and its evolutionary significance.

- Identify three commonly studied attachment patterns and what is known about the development of those patterns.
- Describe what is known about the consequences of secure versus insecure attachment in adult relationships.

Introduction

Some of the most rewarding experiences in people's lives involve the development and maintenance of close relationships. For example, some of the greatest sources of joy involve falling in love, starting a family, being reunited with distant loved ones, and sharing experiences with close others. And, not surprisingly, some of the most painful experiences in people's lives involve the disruption of important social bonds, such as separation from a spouse, losing a parent, or being abandoned by a loved one.

Why do close relationships play such a profound role in human experience? Attachment theory is one approach to understanding the nature of close relationships. In this module, we review the origins of the theory, the core theoretical principles, and some ways in which attachment influences human behavior, thoughts, and feelings across the life course.



Close relationships are the fabric of society, and are integral to the maintenance of our species. [Image: CC0 Public Domain, <https://goo.gl/m25gce>]

Attachment Theory: A Brief History and Core Concepts

Attachment theory was originally developed in the 1940s by John Bowlby, a British psychoanalyst who was attempting to understand the intense distress experienced by infants who had been separated from their parents. Bowlby (1969) observed that infants would go to extraordinary lengths to prevent separation from their parents or to reestablish proximity to a missing parent. For example, he noted that children who had been separated from their parents would often cry, call for their parents, refuse to eat or play, and stand at the door in desperate anticipation of their parents' return. At the time of Bowlby's initial writings, psychoanalytic writers held that these expressions were manifestations of immature defense mechanisms that were operating to repress emotional pain. However, Bowlby observed that such expressions are common to a wide variety of mammalian species and

speculated that these responses to separation may serve an evolutionary function (see Focus Topic 1).

Focus Topic 1:

Focus Topic 1:

Harlow's research on contact comfort

When Bowlby was originally developing his theory of attachment, there were alternative theoretical perspectives on why infants were emotionally attached to their primary caregivers (most often, their biological mothers). Bowlby and other theorists, for example, believed that there was something important about the responsiveness and contact provided by mothers. Other theorists, in contrast, argued that young infants feel emotionally connected to their mothers because mothers satisfy more basic needs, such as the need for food. That is, the child comes to feel emotionally connected to the mother because she is associated with the reduction of primary drives, such as hunger, rather than the reduction of drives that might be relational in nature.

In a classic set of studies, psychologist Harry Harlow placed young monkeys in cages that contained two artificial, surrogate “mothers” (**Harlow, 1958**). One of those surrogates was a simple wire contraption; the other was a wire contraption covered in cloth. Both of the surrogate mothers were equipped with a feeding tube so that Harlow and his colleagues had the option to allow the surrogate to deliver or not deliver milk.

Harlow found that the young macaques spent a disproportionate amount of time with the cloth surrogate as opposed to the wire surrogate. Moreover, this was true even when the infants were fed by the wire surrogate rather than the cloth surrogate. This suggests that the strong emotional bond that infants form with their primary caregivers is rooted in something more than whether the caregiver provides food per se. Harlow's research is now regarded as one of the first experimental demonstrations of the importance of "contact comfort" in the establishment of infant-caregiver bonds.

Drawing on evolutionary theory, Bowlby (1969) argued that these behaviors are adaptive responses to separation from a primary **attachment figure**—a caregiver who provides support, protection, and care. Because human infants, like other mammalian infants, cannot feed or protect themselves, they are dependent upon the care and protection of "older and wiser" adults for survival. Bowlby argued that, over the course of evolutionary history, infants who were able to maintain proximity to an attachment figure would be more likely to survive to a reproductive age.

According to Bowlby, a motivational system, what he called the **attachment behavioral system**, was gradually "designed" by natural selection to regulate proximity to an attachment figure. The attachment system functions much like a thermostat that continuously monitors the ambient temperature of a room, comparing that temperature against a desired state and adjusting behavior (e.g., activating the furnace) accordingly. In the case of the attachment system,

Bowlby argued that the system continuously monitors the accessibility of the primary attachment figure. If the child perceives the attachment figure to be nearby, accessible, and attentive, then the child feels loved, secure, and confident and, behaviorally, is likely to explore his or her environment, play with others, and be sociable. If, however, the child perceives the attachment figure to be inaccessible, the child experiences anxiety and, behaviorally, is likely to exhibit attachment behaviors ranging from simple visual searching on the low extreme to active searching, following, and vocal signaling on the other. These **attachment behaviors** continue either until the child is able to reestablish a desirable level of physical or psychological proximity to the attachment figure or until the child exhausts himself or herself or gives up, as may happen in the context of a prolonged separation or loss.

Individual Differences in Infant Attachment



Think of your earliest memory, does it involve just you, or does it include your loved ones, your family and caretakers? [Image: CC0 Public Domain, <https://goo.gl/m25gce>]

Although Bowlby believed that these basic dynamics captured the way the attachment system works in most children, he recognized that there are individual differences in the way children appraise the accessibility of the attachment figure and how they regulate their attachment behavior in response to threats. However, it was not until his colleague, Mary Ainsworth, began to systematically study

infant–parent separations that a formal understanding of these individual differences emerged. Ainsworth and her students developed a technique called the **strange situation**—a laboratory task for studying infant–parent attachment (Ainsworth, Blehar, Waters, & Wall, 1978). In the strange situation, 12-month-old infants and their parents are brought to the laboratory and, over a period of approximately 20 minutes, are systematically separated from and reunited with one another. In the strange situation, most children (about 60%) behave in the way implied by Bowlby's normative theory. Specifically, they become upset when the parent leaves the room, but, when he or she returns, they actively seek the parent and are easily comforted by him or her. Children who exhibit this pattern of behavior are often called secure. Other children (about 20% or less) are ill at ease initially and, upon separation,

become extremely distressed. Importantly, when reunited with their parents, these children have a difficult time being soothed and often exhibit conflicting behaviors that suggest they want to be comforted, but that they also want to “punish” the parent for leaving. These children are often called anxious-resistant. The third pattern of attachment that Ainsworth and her colleagues documented is often labeled avoidant. Avoidant children (about 20%) do not consistently behave as if they are stressed by the separation but, upon reunion, actively avoid seeking contact with their parent, sometimes turning their attention to play objects on the laboratory floor. Ainsworth's work was important for at least three reasons. First, she provided one of the first empirical demonstrations of how attachment behavior is organized in unfamiliar contexts. Second, she provided the first empirical taxonomy of individual differences in infant **attachment patterns**. According to her research, at least three types of children exist: those who are secure in their relationship with their parents, those who are anxious-resistant, and those who are anxious-avoidant. Finally, she demonstrated that these individual differences were correlated with infant–parent interactions in the home during the first year of life. Children who appear secure in the strange situation, for example, tend to have parents who are responsive to their needs. Children who appear insecure in the strange situation (i.e., anxious-resistant or avoidant) often have parents who are insensitive to their needs, or inconsistent or rejecting in the care they provide.

Antecedents of Attachment Patterns

In the years that have followed Ainsworth's ground-breaking research, researchers have investigated a variety of factors that may help determine whether children develop secure or insecure relationships with their primary attachment figures. As mentioned above, one of the key determinants of attachment patterns is the history of sensitive and responsive interactions between the caregiver and the child. In short, when the



Is attachment style multi-generational? How does one person's childhood attachment style translate to the way they interact with their own children?
[Image: CC0 Public Domain, <https://goo.gl/m25gce>]

child is uncertain or stressed, the ability of the caregiver to provide support to the child is critical for his or her psychological development. It is assumed that such supportive interactions help the child learn to regulate his or her emotions, give the child the confidence to explore the environment, and provide the child with a safe haven during stressful circumstances. Evidence for the role of sensitive caregiving in shaping attachment patterns comes from longitudinal and experimental studies. For example, Grossmann, Grossmann, Spangler, Suess, and Unzner (1985) studied parent-child interactions in the homes of 54 families, up to three times during the first year of the child's life. At 12 months of age, infants and their mothers participated in the strange situation. Grossmann and her colleagues found that children who were classified as secure in the strange situation at 12 months of age were more likely than children classified as insecure to have

mothers who provided responsive care to their children in the home environment. Van den Boom (1994) developed an intervention that was designed to enhance maternal sensitive responsiveness. When the infants were 9 months of age, the mothers in the intervention group were rated as more responsive and attentive in their interaction with their infants compared to mothers in the control group. In addition, their infants were rated as more sociable, self-soothing, and more likely to explore the environment. At 12 months of age, children in the intervention group were more likely to be classified as secure than insecure in the strange situation.

Attachment Patterns and Child Outcomes

Attachment researchers have studied the association between children's attachment patterns and their adaptation over time. Researchers have learned, for example, that children who are classified as secure in the strange situation are more likely to have high functioning relationships with peers, to be evaluated favorably by teachers, and to persist with more diligence in challenging tasks. In contrast, insecure-avoidant children are more likely to be construed as “bullies” or to have a difficult time building and maintaining friendships (Weinfield, Sroufe, Egeland, & Carlson, 2008).

Attachment in Adulthood

Although Bowlby was primarily focused on understanding the nature of the infant-caregiver relationship, he believed that attachment characterized human experience across the life course. It was not until the mid-1980s, however, that researchers began to take seriously the possibility that

attachment processes may be relevant to adulthood. Hazan and Shaver (1987) were two of the first researchers to explore Bowlby's ideas in the context of romantic relationships. According to Hazan and Shaver, the emotional bond that develops between adult romantic partners is partly a function of the same motivational system—the attachment behavioral system—that gives rise to the emotional bond between infants and their caregivers. Hazan and Shaver noted that in both kinds of relationship, people (a) feel safe and secure when the other person is present; (b) turn to the other person during times of sickness, distress, or fear; (c) use the other person as a “secure base” from which to explore the world; and (d) speak to one another in a unique language, often called “motherese” or “baby talk.” (See Focus Topic 2)

Focus Topic 2:

Attachment and social media

Social media websites and mobile communication services are coming to play an increasing role in people's lives. Many people use Facebook, for example, to keep in touch with family and friends, to update their loved ones regarding things going on in their lives, and to meet people who share similar interests. Moreover, modern cellular technology allows people to get in touch with their loved ones much easier than was possible a mere 20 years ago.

From an attachment perspective, these innovations in communications technology are important because they allow people to stay connected virtually to their

attachment figures—regardless of the physical distance that might exist between them. Recent research has begun to examine how attachment processes play out in the use of social media. Oldmeadow, Quinn, and Kowert (2013), for example, studied a diverse sample of individuals and assessed their attachment security and their use of Facebook. Oldmeadow and colleagues found that the use of Facebook may serve attachment functions. For example, people were more likely to report using Facebook to connect with others when they were experiencing negative emotions. In addition, the researchers found that people who were more anxious in their attachment orientation were more likely to use Facebook frequently, but people who were more avoidant used Facebook less and were less open on the site.

On the basis of these parallels, Hazan and Shaver (1987) argued that adult romantic relationships, such as infant–caregiver relationships, are attachments. According to Hazan and Shaver, individuals gradually transfer attachment-related functions from parents to peers as they develop. Thus, although young children tend to use their parents as their primary attachment figures, as they reach adolescence and young adulthood, they come to rely more upon close friends and/or romantic partners for basic attachment-related functions. Thus, although a young child may turn to his or her mother for comfort, support, and guidance when distressed, scared, or ill, young adults may be more likely to turn to their romantic partners for these purposes under similar situations.

Hazan and Shaver (1987) asked a diverse sample of adults to read the three paragraphs below and indicate which

paragraph best characterized the way they think, feel, and behave in close relationships:

1. I am somewhat uncomfortable being close to others; I find it difficult to trust them completely, difficult to allow myself to depend on them. I am nervous when anyone gets too close, and often, others want me to be more intimate than I feel comfortable being.
2. I find it relatively easy to get close to others and am comfortable depending on them and having them depend on me. I don't worry about being abandoned or about someone getting too close to me.
3. I find that others are reluctant to get as close as I would like. I often worry that my partner doesn't really love me or won't want to stay with me. I want to get very close to my partner, and this sometimes scares people away.

Conceptually, these descriptions were designed to represent what Hazan and Shaver considered to be adult analogues of the kinds of attachment patterns Ainsworth described in the strange situation (avoidant, secure, and anxious, respectively). Hazan and Shaver (1987) found that the distribution of the three patterns was similar to that observed in infancy. In other words, about 60% of adults classified themselves as secure (paragraph B), about 20% described themselves as avoidant (paragraph A), and about 20% described themselves as anxious-resistant (paragraph C). Moreover, they found that people who described themselves as secure, for example, were more likely to report having had warm and trusting relationships with their parents when they were growing up. In addition, they were more likely to have positive views of romantic relationships. Based on these findings, Hazan and Shaver (1987) concluded that the same kinds of individual differences that exist in infant attachment also exist in adulthood.

Research on Attachment in Adulthood

Attachment theory has inspired a large amount of literature in social, personality, and clinical psychology. In the sections below, I provide a brief overview of some of the major research questions and what researchers have learned about attachment in adulthood.

Who Ends Up with Whom?



People who had relatively secure attachments as children go on to have more secure romantic attachments. [Image: CC0 Public Domain, <https://goo.gl/m25gce>]

When people are asked what kinds of psychological or behavioral qualities they are seeking in a romantic partner, a large majority of people indicate that they are seeking someone who is kind, caring, trustworthy, and understanding—the kinds of attributes that characterize a “secure” caregiver (**Chappell & Davis, 1998**). But we know that people do not always end up with others who meet their ideals. Are secure

people more likely to end up with secure partners—and, vice versa, are insecure people more likely to end up with insecure partners? The majority of the research that has been conducted to date suggests that the answer is “yes.” Frazier, Byer, Fischer, Wright, and DeBord (**1996**), for example, studied the attachment patterns of more than 83 heterosexual couples and found that, if the man was relatively secure, the woman was also likely to be secure. One important question is whether

these findings exist because (a) secure people are more likely to be attracted to other secure people, (b) secure people are likely to create security in their partners over time, or (c) some combination of these possibilities. Existing empirical research strongly supports the first alternative. For example, when people have the opportunity to interact with individuals who vary in security in a speed-dating context, they express a greater interest in those who are higher in security than those who are more insecure (**McClure, Lydon, Baccus, & Baldwin, 2010**). However, there is also some evidence that people's attachment styles mutually shape one another in close relationships. For example, in a longitudinal study, Hudson, Fraley, Vicary, and Brumbaugh (**2012**) found that, if one person in a relationship experienced a change in security, his or her partner was likely to experience a change in the same direction.

Relationship Functioning

Research has consistently demonstrated that individuals who are relatively secure are more likely than insecure individuals to have high functioning relationships—relationships that are more satisfying, more enduring, and less characterized by conflict. For example, Feeney and Noller (**1992**) found that insecure individuals were more likely than secure individuals to experience a breakup of their relationship. In addition, secure individuals are more likely to report satisfying relationships (e.g., **Collins & Read, 1990**) and are more likely to provide support to their partners when their partners were feeling distressed (**Simpson, Rholes, & Nelligan, 1992**).

Do Early Experiences Shape Adult

Attachment?

The majority of research on this issue is retrospective—that is, it relies on adults' reports of what they recall about their childhood experiences. This kind of work suggests that secure adults are more likely to describe their early childhood experiences with their parents as being supportive, loving, and kind (Hazan & Shaver, 1987). A number of longitudinal studies are emerging that demonstrate prospective



Sharing food, celebrations, and traditions are some of the ways we establish secure attachments with our loved ones from an early age.

[Image: iwona_kellie, <https://goo.gl/B406LK>, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

associations between early attachment experiences and adult attachment styles and/or interpersonal functioning in adulthood. For example, Fraley, Roisman, Booth-LaForce, Owen, and Holland (2013) found in a sample of more than 700 individuals studied from infancy to adulthood that maternal sensitivity across development prospectively predicted security at age 18. Simpson, Collins, Tran, and Haydon (2007) found that attachment security, assessed in infancy in the strange situation, predicted peer competence in grades 1 to 3, which, in turn, predicted the quality of friendship relationships at age 16, which, in turn, predicted the expression of positive and negative emotions in their adult romantic relationships at ages 20 to 23. It is easy to come away from such findings with the mistaken assumption that early experiences “determine” later outcomes. To be clear: Attachment theorists assume that the relationship between early experiences and subsequent outcomes is probabilistic, not deterministic. Having supportive

and responsive experiences with caregivers early in life is assumed to set the stage for positive social development. But that does not mean that attachment patterns are set in stone. In short, even if an individual has far from optimal experiences in early life, attachment theory suggests that it is possible for that individual to develop well-functioning adult relationships through a number of corrective experiences—including relationships with siblings, other family members, teachers, and close friends. Security is best viewed as a culmination of a person's attachment history rather than a reflection of his or her early experiences alone. Those early experiences are considered important not because they determine a person's fate, but because they provide the foundation for subsequent experiences.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Attachment behavioral system

A motivational system selected over the course of evolution to maintain proximity between a young child and his or her primary attachment figure.

Attachment behaviors

Behaviors and signals that attract the attention of a

primary attachment figure and function to prevent separation from that individual or to reestablish proximity to that individual (e.g., crying, clinging).

Attachment figure

Someone who functions as the primary safe haven and secure base for an individual. In childhood, an individual's attachment figure is often a parent. In adulthood, an individual's attachment figure is often a romantic partner.

Attachment patterns

(also called “attachment styles” or “attachment orientations”) Individual differences in how securely (vs. insecurely) people think, feel, and behave in attachment relationships.

Strange situation

A laboratory task that involves briefly separating and reuniting infants and their primary caregivers as a way of studying individual differences in attachment behavior.

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41. Functions of Emotions

Original chapter by Hyisung Hwang and David Matsumoto adapted by the Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

Emotions play a crucial role in our lives because they have important functions. This module describes those functions, dividing the discussion into three areas: the intrapersonal, the interpersonal, and the social and cultural functions of emotions. The section on the intrapersonal functions of emotion describes the roles that emotions play within each of us individually; the section on the interpersonal functions of emotion describes the meanings of emotions to our relationships with others; and the section on the social and cultural functions of emotion describes the roles and meanings that emotions have to the maintenance and effective functioning of our societies and cultures at large. All in all we will see that emotions are a crucially important aspect of our psychological composition, having meaning and function to each of us individually, to our relationships with others in groups, and to our societies as a whole.

Learning Objectives

- Gain an appreciation of the importance of emotion in human life.
- Understand the functions and meanings of emotion in three areas of life: the intrapersonal, interpersonal, and social-cultural.
- Give examples of the role and function of emotion in each of the three areas described.

Introduction

It is impossible to imagine life without emotion. We treasure our feelings—the joy at a ball game, the pleasure of the touch of a loved one, or the fun with friends on a night out. Even negative emotions are important, such as the sadness when a loved one dies, the anger when violated, the fear that overcomes us in a scary or unknown situation, or the guilt or shame toward others when our sins are made public. Emotions color life experiences and give those experiences meaning and flavor.

In fact, emotions play many important roles in people's lives and have been the topic of scientific inquiry in psychology for well over a century (Cannon, **1927**; Darwin, **1872**; James, **1890**). This module explores why we have emotions and why they are



Emotions help us navigate the complex social landscape of our lives. [Image: Gwenaël Piase, <https://goo.gl/d4EDKS>, CC BY-NC-SA 2.0, <https://goo.gl/hSpkVI>]

important. Doing so requires us to understand the function of emotions, and this module does so below by dividing the discussion into three sections. The first concerns the **intrapersonal** functions of emotion, which refer to the role that emotions play within each of us individually. The second concerns the **interpersonal** functions of emotion, which refer to the role emotions play between individuals within a group. The third concerns the **social and cultural** functions of emotion, which refer to the role that emotions play in the maintenance of social order within a society. All in all, we will see that emotions inform us of who we are, what our relationships with others are like, and how to behave in social interactions. Emotions give meaning to events; without emotions, those events would be mere facts. Emotions help coordinate interpersonal relationships. And emotions play an important role in the cultural functioning of keeping human societies together.

Intrapersonal Functions of Emotion

Emotions Help us Act Quickly with Minimal Conscious Awareness

Emotions are rapid information-processing systems that help us act with minimal thinking (**Tooby & Cosmides, 2008**). Problems associated with birth, battle, death, and seduction have occurred throughout evolutionary history and emotions evolved to aid humans in adapting to those problems rapidly and with minimal conscious cognitive intervention. If we did not have emotions, we could not make rapid decisions concerning whether to attack, defend, flee, care for others, reject food, or approach something useful, all of which were

functionally adaptive in our evolutionary history and helped us to survive. For instance, drinking spoiled milk or eating rotten eggs has negative consequences for our welfare. The emotion of disgust, however, helps us immediately take action by not ingesting them in the first place or by vomiting them out. This response is adaptive because it aids, ultimately, in our survival and allows us to act immediately without much thinking. In some instances, taking the time to sit and rationally think about what to do, calculating cost–benefit ratios in one’s mind, is a luxury that might cost one one’s life. Emotions evolved so that we can act without that depth of thinking.

Emotions Prepare the Body for Immediate Action



The emotion of disgust serves to protect us from toxins and contamination, of the physical and moral variety. [Image: Runs with Scissors, <https://goo.gl/FQRxGa>, CC BY-NC 2.0, <https://goo.gl/tgFydH>]

Emotions prepare us for behavior. When triggered, emotions orchestrate systems such as perception, attention, inference, learning, memory, goal choice, motivational priorities, physiological reactions, motor behaviors, and behavioral decision making (Cosmides & Tooby, **2000**; Tooby & Cosmides, **2008**). Emotions simultaneously activate certain systems and deactivate others in order to prevent the chaos of

competing systems operating at the same time, allowing for coordinated responses to environmental stimuli (**Levenson,**

1999). For instance, when we are afraid, our bodies shut down temporarily unneeded digestive processes, resulting in saliva reduction (a dry mouth); blood flows disproportionately to the lower half of the body; the visual field expands; and air is breathed in, all preparing the body to flee. Emotions initiate a system of components that includes subjective experience, expressive behaviors, physiological reactions, action tendencies, and cognition, all for the purposes of specific actions; the term “emotion” is, in reality, a metaphor for these reactions.

One common misunderstanding many people have when thinking about emotions, however, is the belief that emotions must always directly produce action. This is not true. Emotion certainly *prepares* the body for action; but whether people actually engage in action is dependent on many factors, such as the context within which the emotion has occurred, the target of the emotion, the perceived consequences of one's actions, previous experiences, and so forth (**Baumeister, Vohs, DeWall, & Zhang, 2007; Matsumoto & Wilson, 2008**). Thus, emotions are just one of many determinants of behavior, albeit an important one.

Emotions Influence Thoughts

Emotions are also connected to thoughts and memories. Memories are not just facts that are encoded in our brains; they are colored with the emotions felt at those times the facts occurred (**Wang & Ross, 2007**). Thus, emotions serve as the neural glue that connects those disparate facts in our minds. That is why it is easier to remember happy thoughts when happy, and angry times when angry. Emotions serve as the affective basis of many attitudes, values, and beliefs that we have about the world and the people around us; without emotions those attitudes, values, and beliefs would be just

statements without meaning, and emotions give those statements meaning. Emotions influence our thinking processes, sometimes in constructive ways, sometimes not. It is difficult to think critically and clearly when we feel intense emotions, but easier when we are not overwhelmed with emotions (**Matsumoto, Hirayama, & LeRoux, 2006**).

Emotions Motivate Future Behaviors

Because emotions prepare our bodies for immediate action, influence thoughts, and can be felt, they are important motivators of future behavior. Many of us strive to experience the feelings of satisfaction, joy, pride, or triumph in our accomplishments and achievements. At the same time, we also work very hard to avoid strong negative feelings; for example, once we have felt the emotion of disgust when drinking the spoiled milk, we generally work very hard to avoid having those feelings again (e.g., checking the expiration date on the label before buying the milk, smelling the milk before drinking it, watching if the milk curdles in one's coffee before drinking it). Emotions, therefore, not only influence immediate actions but also serve as an important motivational basis for future behaviors.

Interpersonal Functions of Emotion

Emotions are expressed both verbally through words and nonverbally through facial expressions, voices, gestures, body postures, and movements. We are constantly expressing emotions when interacting with others, and others can reliably judge those emotional expressions (Elfenbein & Ambady, 2002; Matsumoto, 2001); thus, emotions have signal value to others and influence others and our social interactions.



Emotions can act as signals to our friends and partners, conveying information about the quality of the relationship. [Image: mynameisharsha, <https://goo.gl/HY2XgV>, CC BY-SA 2.0, <https://goo.gl/rxiUsF>]

Emotions and their expressions communicate information to others about our feelings, intentions, relationship with the target of the emotions, and the environment. Because emotions have this communicative signal value, they help solve social problems by evoking responses from others, by signaling the nature of interpersonal relationships, and by providing incentives for desired social behavior (Keltner, 2003).

Emotional Expressions Facilitate Specific Behaviors in Perceivers

Because facial expressions of emotion are universal social signals, they contain meaning not only about the expressor's psychological state but also about that person's intent and

subsequent behavior. This information affects what the perceiver is likely to do. People observing fearful faces, for instance, are more likely to produce approach-related behaviors, whereas people who observe angry faces are more likely to produce avoidance-related behaviors (**Marsh, Ambady, & Kleck, 2005**). Even subliminal presentation of smiles produces increases in how much beverage people pour and consume and how much they are willing to pay for it; presentation of angry faces decreases these behaviors (Winkielman, Berridge, & Wilbarger, **2005**). Also, emotional displays evoke specific, complementary emotional responses from observers; for example, anger evokes fear in others (Dimberg & Ohman, **1996**; Esteves, Dimberg, & Ohman, **1994**), whereas distress evokes sympathy and aid (Eisenberg et al., **1989**).

Emotional Expressions Signal the Nature of Interpersonal Relationships

Emotional expressions provide information about the nature of the relationships among interactants. Some of the most important and provocative set of findings in this area come from studies involving married couples (Gottman & Levenson, **1992**; Gottman, Levenson, & Woodin, **2001**). In this research, married couples visited a laboratory after having not seen each other for 24 hours, and then engaged in intimate conversations about daily events or issues of conflict. Discrete expressions of contempt, especially by the men, and disgust, especially by the women, predicted later marital dissatisfaction and even divorce.

Emotional Expressions Provide Incentives

for Desired Social Behavior

Facial expressions of emotion are important regulators of social interaction. In the developmental literature, this concept has been investigated under the concept of **social referencing** (**Klinnert, Campos, & Sorce, 1983**); that is, the process whereby infants seek out information from others to clarify a situation and then use that information to act. To date, the strongest demonstration of social referencing comes from work on the visual cliff. In the first study to investigate this concept, Campos and colleagues (**Sorce, Emde, Campos, & Klinnert, 1985**) placed mothers on the far end of the “cliff” from the infant. Mothers first smiled to the infants and placed a toy on top the safety glass to attract them; infants invariably began crawling to their mothers. When the infants were in the center of the table, however, the mother then posed an expression of fear, sadness, anger, interest, or joy. The results were clearly different for the different faces; no infant crossed the table when the mother showed fear; only 6% did when the mother posed anger, 33% crossed when the mother posed sadness, and approximately 75% of the infants crossed when the mother posed joy or interest.

Other studies provide similar support for facial expressions as regulators of social interaction. In one study (**Bradshaw, 1986**), experimenters posed facial expressions of neutral, anger, or disgust toward babies as they moved toward an object and measured the amount of inhibition the babies showed in touching the object. The results for 10- and 15-month olds were the same: anger produced the greatest inhibition, followed by disgust, with neutral the least. This study was later replicated (**Hertenstein & Campos, 2004**) using joy and disgust expressions, altering the method so that the infants were not allowed to touch the toy (compared with a distractor object) until one hour after exposure to the expression. At 14 months of age, significantly more infants touched the toy when they saw

joyful expressions, but fewer touched the toy when the infants saw disgust.

Social and Cultural Functions of Emotion



Although there are cultural differences in the display of emotion, almost all infants start showing emotion such as smiling or reacting to their caretaker as early as 6 weeks after their birth. [Image: vgm8383, <https://goo.gl/jgfRDN>, CC BY-NC 2.0, <https://goo.gl/VnKlK8>]

If you stop to think about many things we take for granted in our daily lives, we cannot help but come to the conclusion that modern human life is a colorful tapestry of many groups and individual lives woven together in a complex yet functional way. For example, when you're hungry, you might go to the local grocery store and buy some food. Ever stop to think about how you're able to do that? You might buy a banana that was grown in a field in southeast Asia being raised by farmers

there, where they planted the tree, cared for it, and picked the fruit. They probably handed that fruit off to a distribution chain that allowed multiple people somewhere to use tools such as cranes, trucks, cargo bins, ships or airplanes (that were also created by multiple people somewhere) to bring that banana to your store. The store had people to care for that banana until you came and got it and to barter with you for it (with your money). You may have gotten to the store riding a vehicle that was produced somewhere else in the world by others, and you

were probably wearing clothes produced by some other people somewhere else.

Thus, human social life is complex. Individuals are members of multiple groups, with multiple social roles, norms, and expectations, and people move rapidly in and out of the multiple groups of which they are members. Moreover, much of human social life is unique because it revolves around cities, where many people of disparate backgrounds come together. This creates the enormous potential for social chaos, which can easily occur if individuals are not coordinated well and relationships not organized systematically.

One of the important functions of culture is to provide this necessary coordination and organization. Doing so allows individuals and groups to negotiate the social complexity of human social life, thereby maintaining social order and preventing social chaos. Culture does this by providing a meaning and information system to its members, which is shared by a group and transmitted across generations, that allows the group to meet basic needs of survival, pursue happiness and well-being, and derive meaning from life (**Matsumoto & Juang, 2013**). Culture is what allowed the banana from southeast Asia to appear on your table.

The Role of Emotions in the Function of Culture

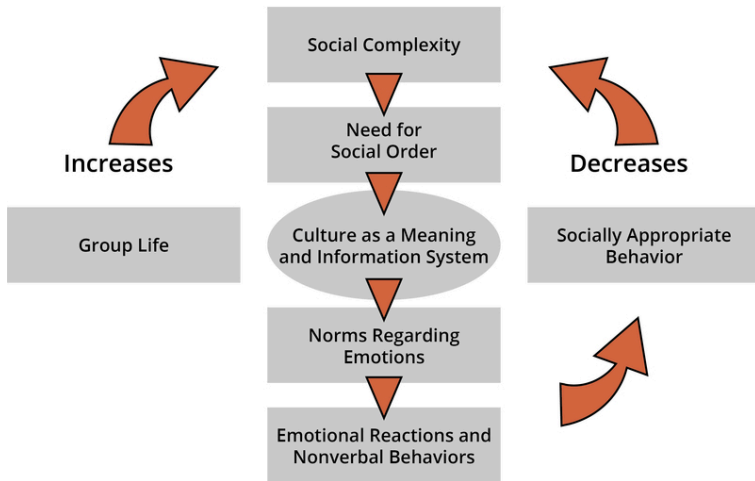


Figure 1: The Role of Emotions in the Function of Culture

Cultural transmission of the meaning and information system to its members is, therefore, a crucial aspect of culture. One of the ways this transmission occurs is through the development of worldviews (including attitudes, values, beliefs, and norms) related to emotions (**Matsumoto & Hwang, 2013; Matsumoto et al., 2008**). Worldviews related to emotions provide guidelines for desirable emotions that facilitate norms for regulating individual behaviors and interpersonal relationships. Our cultural backgrounds tell us which emotions are ideal to have, and which are not (**Tsai, Knutson, & Fung, 2006**). The cultural transmission of information related to emotions occurs in many ways, from childrearsers to children, as well as from the cultural products available in our world, such as books, movies, ads, and the like (**Schönplflug, 2009; Tsai, Louie, Chen, & Uchida, 2007**).

Cultures also inform us about what to do with our emotions—that is, how to manage or modify them—when we experience them. One of the ways in which this is done is through the management of our emotional expressions through **cultural display rules** (Friesen, 1972). These are rules that are learned early in life that specify the management and modification of our emotional expressions according to social circumstances. Thus, we



Cultural display rules teach us how to manage our emotions. For example, in many Asian countries children are taught to mute their emotions, especially negative emotions like anger. [Image: john.gillespie, <https://goo.gl/gTdPYb>, CC BY-SA 3.0, <https://goo.gl/eLCn2O>]

learn that “big boys don’t cry” or to laugh at the boss’s jokes even though they’re not funny. By affecting how individuals express their emotions, culture also influences how people experience them as well.

Because one of the major functions of culture is to maintain social order in order to ensure group efficiency and thus survival, cultures create worldviews, rules, guidelines, and norms concerning emotions because emotions have important intra- and interpersonal functions, as described above, and are important motivators of behavior. Norms concerning emotion and its regulation in all cultures serve the purpose of maintaining social order. Cultural worldviews and norms help us manage and modify our emotional reactions (and thus behaviors) by helping us to have certain kinds of emotional experiences in the first place and by managing our reactions and subsequent behaviors once we have them. By doing so, our culturally moderated emotions can help us

engage in socially appropriate behaviors, as defined by our cultures, and thus reduce social complexity and increase social order, avoiding social chaos. All of this allows us to live relatively harmonious and constructive lives in groups. If cultural worldviews and norms about emotions did not exist, people would just run amok having all kinds of emotional experiences, expressing their emotions and then behaving in all sorts of unpredictable and potentially harmful ways. If that were the case, it would be very difficult for groups and societies to function effectively, and even for humans to survive as a species, if emotions were not regulated in culturally defined ways for the common, social good. Thus, emotions play a critical role in the successful functioning of any society and culture.

The Study of Emotions at Queen's University

Dr. Tom Hollenstein is a psychological scientist who studies socioemotional development. In this video, Dr. Hollenstein discusses the importance of emotion regulation, and ways of facilitating emotion regulation.



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To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Cultural display rules

These are rules that are learned early in life that specify the management and modification of emotional expressions according to social circumstances. Cultural display rules can work in a number of different ways. For example, they can require individuals to express emotions “as is” (i.e., as they feel them), to exaggerate their expressions to show more than what is actually felt, to tone down their expressions to show less than what is actually felt, to conceal their feelings by expressing something else, or to show nothing at all.

Interpersonal

This refers to the relationship or interaction between two or more individuals in a group. Thus, the interpersonal functions of emotion refer to the effects of one's emotion on others, or to the relationship between oneself and others.

Intrapersonal

This refers to what occurs within oneself. Thus, the intrapersonal functions of emotion refer to the effects of emotion to individuals that occur physically inside their bodies and psychologically inside their minds.

Social and cultural

Society refers to a system of relationships between individuals and groups of individuals; culture refers to the meaning and information afforded to that system that is transmitted across generations. Thus, the social and cultural functions of emotion refer to the effects that emotions have on the functioning and maintenance of societies and cultures.

Social referencing

This refers to the process whereby individuals look for information from others to clarify a situation, and then use that information to act. Thus, individuals will often use the emotional expressions of others as a source of information to make decisions about their own behavior.

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PSYC 100 XV

ADOLESCENCE, EMERGING ADULTHOOD, AND AGING

42. Adolescent Development By Jennifer Lansford

Original chapter by Jennifer Lansford
adapted by the Queen's University
Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen’s Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

Adolescence is a period that begins with puberty and ends with the transition to adulthood (approximately ages 10–20). Physical changes associated with puberty are triggered by hormones. Cognitive changes include improvements in complex and abstract thought, as well as development that happens at different rates in distinct parts of the brain and increases adolescents’ propensity for risky behavior because increases in sensation-seeking and reward motivation precede increases in cognitive control. Adolescents’ relationships with parents go through a period of redefinition in which adolescents become more autonomous, and aspects of parenting, such as distal monitoring and psychological control, become more salient. Peer relationships are important sources of support and companionship during adolescence yet can also promote problem behaviors. Same-sex peer groups evolve

into mixed-sex peer groups, and adolescents' romantic relationships tend to emerge from these groups. Identity formation occurs as adolescents explore and commit to different roles and ideological positions. Nationality, gender, ethnicity, socioeconomic status, religious background, sexual orientation, and genetic factors shape how adolescents behave and how others respond to them, and are sources of diversity in adolescence

Learning Objectives

- Describe major features of physical, cognitive, and social development during adolescence.
- Understand why adolescence is a period of heightened risk taking.
- Be able to explain sources of diversity in adolescent development.

Adolescence Defined

Adolescence is often characterized as a period of transformation, primarily, in terms of physical, cognitive, and social-relational change.



[Image: CC0 Public Domain, <https://goo.gl/m25gce>]

Adolescence is a developmental stage that has been defined as starting with puberty and ending with the transition to adulthood (approximately ages 10–20). Adolescence has evolved historically, with evidence indicating that this stage is lengthening as individuals start puberty earlier and transition to adulthood later than in the past. Puberty today begins, on average, at age 10–11 years for girls and 11–12 years for boys. This average age of onset has decreased gradually over time since the 19th century by 3–4 months per decade, which has been attributed to a range of factors including better nutrition, obesity, increased father absence, and other environmental factors (**Steinberg, 2013**). Completion of formal education, financial independence from parents, marriage, and parenthood have all been markers of the end of adolescence and beginning of adulthood, and all of these transitions

happen, on average, later now than in the past. In fact, the prolonging of adolescence has prompted the introduction of a new developmental period called *emerging adulthood* that captures these developmental changes out of adolescence and into adulthood, occurring from approximately ages 18 to 29 (**Arnett, 2000**). This module will outline changes that occur during adolescence in three domains: physical, cognitive, and social. Within the social domain, changes in relationships with parents, peers, and romantic partners will be considered. Next, the module turns to adolescents' psychological and behavioral adjustment, including identity formation, aggression and antisocial behavior, anxiety and depression, and academic achievement. Finally, the module summarizes sources of diversity in adolescents' experiences and development.

Physical Changes

Physical changes of puberty mark the onset of adolescence (**Lerner & Steinberg, 2009**). For both boys and girls, these changes include a growth spurt in height, growth of pubic and underarm hair, and skin changes (e.g., pimples). Boys also experience growth in facial hair and a deepening of their voice. Girls experience breast development and begin menstruating. These pubertal changes are driven by hormones, particularly an increase in testosterone for boys and estrogen for girls.

Cognitive Changes

Major changes in the structure and functioning of the brain occur during adolescence and result in cognitive and behavioral developments (Steinberg, 2008). Cognitive changes during adolescence include a shift from concrete to more abstract and complex thinking. Such changes are fostered by improvements during early adolescence in attention, memory, processing speed, and metacognition (ability to think about thinking and therefore make better use of



Dopamine is a neurotransmitter in the brain that produces feelings of pleasure. During adolescence, people tend to do whatever activities produce the most dopamine, without fully considering the consequences of such actions. [Image: CCO Public Domain, <https://goo.gl/m25gce>]

strategies like mnemonic devices that can improve thinking). Early in adolescence, changes in the brain's dopaminergic system contribute to increases in adolescents' sensation-seeking and reward motivation. Later in adolescence, the brain's cognitive control centers in the prefrontal cortex develop, increasing adolescents' self-regulation and future orientation. The difference in timing of the development of these different regions of the brain contributes to more risk taking during middle adolescence because adolescents are motivated to seek thrills that sometimes come from risky behavior, such as reckless driving, smoking, or drinking, and have not yet developed the cognitive control to resist impulses or focus equally on the potential risks (Steinberg, 2008). One of the world's leading experts on adolescent development, Laurence Steinberg, likens this to engaging a powerful engine

before the braking system is in place. The result is that adolescents are more prone to risky behaviors than are children or adults.

Social Changes

Parents

Although peers take on greater importance during adolescence, family relationships remain important too. One of the key changes during adolescence involves a renegotiation of parent-child relationships. As adolescents strive for more independence and autonomy during this time, different aspects of parenting become more salient. For example, parents' distal supervision and monitoring become more important as adolescents spend more time away from parents and in the presence of peers. Parental monitoring encompasses a wide range of behaviors such as parents' attempts to set rules and know their adolescents' friends, activities, and whereabouts, in addition to adolescents' willingness to disclose information to their parents (**Stattin & Kerr, 2000**). **Psychological control**, which involves manipulation and intrusion into adolescents' emotional and cognitive world through invalidating adolescents' feelings and pressuring them to think in particular ways (**Barber, 1996**), is another aspect of parenting that becomes more salient during adolescence and is related to more problematic adolescent adjustment.

Peers

Peer relationships are a big part of adolescent development. The influence of peers can be both positive and negative as adolescents experiment together with identity formation and new experiences.



[Image: Alex Proimos, <https://goo.gl/ljqpnI>, CC BY-NC 2.0, <https://goo.gl/VnKIK8>]

As children become adolescents, they usually begin spending more time with their peers and less time with their

families, and these peer interactions are increasingly unsupervised by adults. Children's notions of friendship often focus on shared activities, whereas adolescents' notions of friendship increasingly focus on intimate exchanges of thoughts and feelings. During adolescence, peer groups evolve from primarily single-sex to mixed-sex. Adolescents within a peer group tend to be similar to one another in behavior and attitudes, which has been explained as being a function of **homophily** (adolescents who are similar to one another choose to spend time together in a "birds of a feather flock together" way) and influence (adolescents who spend time together shape each other's behavior and attitudes). One of the most widely studied aspects of adolescent peer influence is known as **deviant peer contagion** (Dishion & Tipsord, 2011), which is the process by which peers reinforce problem behavior by laughing or showing other signs of approval that then increase the likelihood of future problem behavior. Peers can serve both positive and negative functions during adolescence. Negative peer pressure can lead adolescents to make riskier decisions or engage in more problematic behavior than they would alone or in the presence of their family. For example, adolescents are much more likely to drink alcohol, use drugs, and commit crimes when they are with their friends than when they are alone or with their family. However, peers also serve as an important source of social support and companionship during adolescence, and adolescents with positive peer relationships are happier and better adjusted than those who are socially isolated or have conflictual peer relationships. **Crowds** are an emerging level of peer relationships in adolescence. In contrast to friendships (which are reciprocal dyadic relationships) and cliques (which refer to groups of individuals who interact frequently), crowds are characterized more by shared reputations or images than actual interactions (Brown & Larson, 2009). These crowds reflect different prototypic identities (such as jocks or brains)

and are often linked with adolescents' social status and peers' perceptions of their values or behaviors.

Romantic relationships

Adolescence is the developmental period during which romantic relationships typically first emerge. Initially, same-sex peer groups that were common during childhood expand into mixed-sex peer groups that are more characteristic of adolescence. Romantic relationships often form in the context of these mixed-sex peer groups (**Connolly, Furman, & Konarski, 2000**). Although romantic relationships during adolescence are often short-lived rather than long-term committed partnerships, their importance should not be minimized. Adolescents spend a great deal of time focused on romantic relationships, and their positive and negative emotions are more tied to romantic relationships (or lack thereof) than to friendships, family relationships, or school (**Furman & Shaffer, 2003**). Romantic relationships contribute to adolescents' identity formation, changes in family and peer relationships, and adolescents' emotional and behavioral adjustment.

Furthermore, romantic relationships are centrally connected to adolescents' emerging sexuality. Parents, policymakers, and researchers have devoted a great deal of attention to adolescents' sexuality, in large part because of concerns related to sexual intercourse, contraception, and preventing teen pregnancies. However, sexuality involves more than this narrow focus. For example, adolescence is often when individuals who are lesbian, gay, bisexual, or transgender come to perceive themselves as such (**Russell, Clarke, & Clary, 2009**). Thus, romantic relationships are a domain in which adolescents experiment with new behaviors and identities.

Behavioral and Psychological Adjustment

Identity formation

Theories of adolescent development often focus on identity formation as a central issue. For example, in Erikson's (1968) classic theory of developmental stages, identity formation was highlighted as the primary indicator of successful development during adolescence (in contrast to role confusion, which would be an indicator of not successfully meeting the task of adolescence). Marcia (1966) described identity formation during adolescence as involving both decision points and commitments with respect to ideologies (e.g., religion, politics) and occupations. He described four identity statuses: foreclosure, identity diffusion, moratorium, and identity achievement. **Foreclosure** occurs when an individual commits to an identity without exploring options. **Identity diffusion** occurs when adolescents neither explore nor commit to any identities. **Moratorium** is a state in which adolescents are actively exploring options but have not yet made commitments. **Identity achievement** occurs when individuals have explored different options and then made identity commitments. Building on this work, other researchers have investigated more specific aspects of identity. For example, Phinney (1989) proposed a model of ethnic identity development that included stages of unexplored ethnic identity, ethnic identity search, and achieved ethnic identity.

Aggression and antisocial behavior

Several major theories of the development of antisocial behavior treat adolescence as an important period. Patterson's (1982) early versus late starter model of the development of aggressive and antisocial behavior distinguishes youths whose antisocial behavior begins during childhood (early starters) versus adolescence (late starters). According to the theory, early starters are at greater risk for long-term antisocial behavior that



Early, antisocial behavior leads to befriending others who also engage in antisocial behavior, which only perpetuates the downward cycle of aggression and wrongful acts. [Image: Philippe Put, <https://goo.gl/14H7HL>, CC BY 2.0, <https://goo.gl/BRvSA7>]

extends into adulthood than are late starters. Late starters who become antisocial during adolescence are theorized to experience poor parental monitoring and supervision, aspects of parenting that become more salient during adolescence. Poor monitoring and lack of supervision contribute to increasing involvement with deviant peers, which in turn promotes adolescents' own antisocial behavior. Late starters desist from antisocial behavior when changes in the environment make other options more appealing. Similarly, Moffitt's (1993) life-course persistent versus adolescent-limited model distinguishes between antisocial behavior that begins in childhood versus adolescence. Moffitt regards adolescent-limited antisocial behavior as resulting from a "maturity gap" between adolescents' dependence on and control by adults and their desire to demonstrate their freedom from adult constraint. However, as they continue to develop, and

legitimate adult roles and privileges become available to them, there are fewer incentives to engage in antisocial behavior, leading to desistance in these antisocial behaviors.

Anxiety and depression

Developmental models of anxiety and depression also treat adolescence as an important period, especially in terms of the emergence of gender differences in prevalence rates that persist through adulthood (**Rudolph, 2009**). Starting in early adolescence, compared with males, females have rates of anxiety that are about twice as high and rates of depression that are 1.5 to 3 times as high (**American Psychiatric Association, 2013**). Although the rates vary across specific anxiety and depression diagnoses, rates for some disorders are markedly higher in adolescence than in childhood or adulthood. For example, prevalence rates for specific phobias are about 5% in children and 3%–5% in adults but 16% in adolescents. Anxiety and depression are particularly concerning because suicide is one of the leading causes of death during adolescence. Developmental models focus on interpersonal contexts in both childhood and adolescence that foster depression and anxiety (e.g., **Rudolph, 2009**). Family adversity, such as abuse and parental psychopathology, during childhood sets the stage for social and behavioral problems during adolescence. Adolescents with such problems generate stress in their relationships (e.g., by resolving conflict poorly and excessively seeking reassurance) and select into more maladaptive social contexts (e.g., “misery loves company” scenarios in which depressed youths select other depressed youths as friends and then frequently co-ruminate as they discuss their problems, exacerbating negative affect and stress). These processes are intensified for girls compared with boys because girls have more relationship-oriented goals

related to intimacy and social approval, leaving them more vulnerable to disruption in these relationships. Anxiety and depression then exacerbate problems in social relationships, which in turn contribute to the stability of anxiety and depression over time.

Academic achievement

Adolescents spend more waking time in school than in any other context (**Eccles & Roeser, 2011**). Academic achievement during adolescence is predicted by interpersonal (e.g., parental engagement in adolescents' education), intrapersonal (e.g., intrinsic motivation), and institutional (e.g., school quality) factors. Academic achievement is important in its own right as a marker of positive adjustment during adolescence but also because academic achievement sets the stage for future educational and occupational opportunities. The most serious consequence of school failure, particularly dropping out of school, is the high risk of unemployment or underemployment in adulthood that follows. High achievement can set the stage for college or future vocational training and opportunities.

Diversity



Diversity can span many factors.

Adolescent development does not necessarily follow the same pathway for all individuals. Certain features of adolescence, particularly with respect to biological changes associated with puberty and cognitive

changes associated with brain development, are relatively universal. But other features of adolescence depend largely on circumstances that are more environmentally variable. For example, adolescents growing up in one country might have different opportunities for risk taking than adolescents in a different country, and supports and sanctions for different behaviors in adolescence depend on laws and values that might be specific to where adolescents live. Likewise, different cultural norms regarding family and peer relationships shape adolescents' experiences in these domains. For example, in some countries, adolescents' parents are expected to retain control over major decisions, whereas in other countries, adolescents are expected to begin sharing in or taking control of decision making. Even within the same country, adolescents' gender, ethnicity, immigrant status, religion, sexual orientation, socioeconomic status, and personality can shape both how adolescents behave and how others respond to them, creating diverse developmental contexts for different adolescents. For example, early puberty (that occurs before most other peers have experienced puberty) appears to be associated with worse outcomes for girls than boys, likely in part because girls who enter puberty early tend to associate with older boys, which in turn is associated with early sexual behavior and substance use. For adolescents who are ethnic or sexual minorities, discrimination sometimes presents a set of challenges that nonminorities do not face. Finally, genetic variations contribute an additional source of diversity in adolescence. Current approaches emphasize gene X environment interactions, which often follow a **differential susceptibility** model (Belsky & Pluess, 2009). That is, particular genetic variations are considered riskier than others, but genetic variations also can make adolescents more or less susceptible to environmental factors. For example, the association between the CHRM2 genotype and adolescent externalizing behavior (aggression and delinquency) has been

found in adolescents whose parents are low in monitoring behaviors (**Dick et al., 2011**). Thus, it is important to bear in mind that individual differences play an important role in adolescent development.

Conclusions

Adolescent development is characterized by biological, cognitive, and social changes. Social changes are particularly notable as adolescents become more autonomous from their parents, spend more time with peers, and begin exploring romantic relationships and sexuality. Adjustment during adolescence is reflected in identity formation, which often involves a period of exploration followed by commitments to particular identities. Adolescence is characterized by risky behavior, which is made more likely by changes in the brain in which reward-processing centers develop more rapidly than cognitive control systems, making adolescents more sensitive to rewards than to possible negative consequences. Despite these generalizations, factors such as country of residence, gender, ethnicity, and sexual orientation shape development in ways that lead to diversity of experiences across adolescence.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You

can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Crowds

Adolescent peer groups characterized by shared reputations or images.

Deviant peer contagion

The spread of problem behaviors within groups of adolescents.

Differential susceptibility

Genetic factors that make individuals more or less responsive to environmental experiences.

Foreclosure

Individuals commit to an identity without exploration of options.

Homophily

Adolescents tend to associate with peers who are similar to themselves.

Identity achievement

Individuals have explored different options and then made commitments.

Identity diffusion

Adolescents neither explore nor commit to any roles or ideologies.

Moratorium

State in which adolescents are actively exploring options but have not yet made identity commitments.

Psychological control

Parents' manipulation of and intrusion into adolescents' emotional and cognitive world through invalidating adolescents' feelings and pressuring them to think in particular ways.

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43. Emerging Adulthood

Original chapter by Jeffrey Jensen Arnet
adapted by the Queen's University
Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

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Emerging adulthood has been proposed as a new life stage between adolescence and young adulthood, lasting roughly from ages 18 to 25. Five features make emerging adulthood distinctive: identity explorations, instability, self-focus, feeling in-between adolescence and adulthood, and a sense of broad possibilities for the future. Emerging adulthood is found mainly in industrialized countries, where most young people obtain tertiary education and median ages of entering marriage and parenthood are around 30. There are variations in emerging adulthood within industrialized countries. It lasts longest in Europe, and in Asian industrialized countries, the self-focused freedom of emerging adulthood is balanced by obligations to parents and by conservative views of sexuality. In non-industrialized countries, although today emerging adulthood exists only among the middle-class elite, it can be expected to grow in the 21st century as these countries become more affluent.

Learning Objectives

- Explain where, when, and why a new life stage of emerging adulthood appeared over the past half-century.
- Identify the five features that distinguish emerging adulthood from other life stages.
- Describe the variations in emerging adulthood in countries around the world.

Introduction

Think for a moment about the lives of your grandparents and great-grandparents when they were in their twenties. How do their lives at that age compare to your life? If they were like most other people of their time, their lives were quite different than yours. What happened to change the twenties so much between their time and our own? And how should we understand the 18–25 age period today?



In industrialized countries young people just out of high school and into their 20's are spending more time experimenting with potential directions for their lives. This new way of transitioning into adulthood is different enough from generations past that it is considered a new developmental phase – Emerging Adulthood. [Image: City Year, <https://goo.gl/1ZGKWw>, CC BY-NC-ND 2.0, <https://goo.gl/62XJAI>]

The theory of emerging adulthood proposes that a new life stage has arisen between adolescence and young adulthood over the past half-century in industrialized countries. Fifty years ago, most young people in these countries had entered stable adult roles in love and work by their late teens or early twenties. Relatively few people pursued education or training beyond secondary school, and, consequently, most young men were full-time workers by the end of their teens. Relatively few women worked in occupations outside the

home, and the median marriage age for women in the United States and in most other industrialized countries in 1960 was around 20 (Arnett & Taber, **1994**; Douglass, **2005**). The median marriage age for men was around 22, and married couples usually had their first child about one year after their wedding day. All told, for most young people half a century ago, their teenage adolescence led quickly and directly to stable adult roles in love and work by their late teens or early twenties. These roles would form the structure of their adult lives for decades to come.

Now all that has changed. A higher proportion of young people than ever before—about 70% in the United States—pursue education and training beyond secondary school (**National Center for Education Statistics, 2012**). The

early twenties are not a time of entering stable adult work but a time of immense job instability: In the United States, the average number of job changes from ages 20 to 29 is seven. The median age of entering marriage in the United States is now 27 for women and 29 for men (**U.S. Bureau of the Census, 2011**). Consequently, a new stage of the life span, **emerging adulthood**, has been created, lasting from the late teens through the mid-twenties, roughly ages 18 to 25.

The Five Features of Emerging Adulthood

Five characteristics distinguish emerging adulthood from other life stages (**Arnett, 2004**). Emerging adulthood is:

1. the age of identity explorations;
2. the age of instability;
3. the self-focused age;
4. the age of feeling in-between; and
5. the age of possibilities.

Perhaps the most distinctive characteristic of emerging adulthood is that it is the age of identity explorations. That is, it is an age when people explore various possibilities in love and work as they move toward making enduring choices. Through trying out these different possibilities, they develop a more definite identity, including an understanding of who they are, what their capabilities and limitations are, what



The years of emerging adulthood are often times of identity exploration through work, fashion, music, education, and other venues. [Image: CC0 Public Domain, <https://goo.gl/m25gce>]

their beliefs and values are, and how they fit into the society around them. Erik Erikson (1950), who was the first to develop the idea of identity, proposed that it is mainly an issue in adolescence; but that was more than 50 years ago, and today it is mainly in emerging adulthood that identity explorations take place (Côté, 2006).

The explorations of emerging adulthood also make it the age of instability. As emerging adults explore different possibilities in love and work, their lives are often unstable. A good illustration of this instability is their frequent moves from one residence to another. Rates of residential change in American society are much higher at ages 18 to 29 than at any other period of life (Arnett, 2004). This reflects the explorations going on in emerging adults' lives. Some move out of their parents' household for the first time in their late teens to attend a residential college, whereas others move out simply to be independent (Goldscheider & Goldscheider, 1999). They may move again when they drop out of college or when they graduate. They may move to cohabit with a romantic partner,

and then move out when the relationship ends. Some move to another part of the country or the world to study or work. For nearly half of American emerging adults, residential change includes moving back in with their parents at least once (**Goldscheider & Goldscheider, 1999**). In some countries, such as in southern Europe, emerging adults remain in their parents' home rather than move out; nevertheless, they may still experience instability in education, work, and love relationships (**Douglass, 2005, 2007**).

Emerging adulthood is also a self-focused age. Most American emerging adults move out of their parents' home at age 18 or 19 and do not marry or have their first child until at least their late twenties (**Arnett, 2004**). Even in countries where emerging adults remain in their parents' home through their early twenties, as in southern Europe and in Asian countries such as Japan, they establish a more independent lifestyle than they had as adolescents (**Rosenberger, 2007**). Emerging adulthood is a time between adolescents' reliance on parents and adults' long-term commitments in love and work, and during these years, emerging adults focus on themselves as they develop the knowledge, skills, and self-understanding they will need for adult life. In the course of emerging adulthood, they learn to make independent decisions about everything from what to have for dinner to whether or not to get married.

Another distinctive feature of emerging adulthood is that it is an age of feeling in-between, not adolescent but not fully adult, either. When asked, "Do you feel that you have reached adulthood?" the majority of emerging adults respond neither yes nor no but with the ambiguous "in some ways yes, in some ways no" (**Arnett, 2003, 2012**). It is only when people reach their late twenties and early thirties that a clear majority feels adult. Most emerging adults have the subjective feeling of being in a transitional period of life, on the way to adulthood but not there yet. This "in-between" feeling in emerging adulthood has been

found in a wide range of countries, including Argentina (**Facio & Micocci, 2003**), Austria (**Sirsch, Dreher, Mayr, & Willinger, 2009**), Israel (**Mayseless & Scharf, 2003**), the Czech Republic (**Macek, Bejček, & Vaníčková, 2007**), and China (**Nelson & Chen, 2007**).

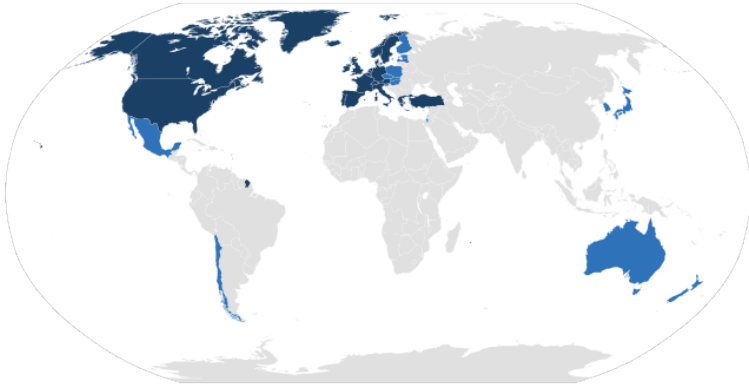
Finally, emerging adulthood is the age of possibilities, when many different futures remain possible, and when little about a person's direction in life has been decided for certain. It tends to be an age of high hopes and great expectations, in part because few of their dreams have been tested in the fires of real life. In one national survey of 18- to 24-year-olds in the United States, nearly all—89%—agreed with the statement, “I am confident that one day I will get to where I want to be in life” (**Arnett & Schwab, 2012**). This optimism in emerging adulthood has been found in other countries as well (**Nelson & Chen, 2007**).

International Variations

The five features proposed in the theory of emerging adulthood originally were based on research involving about 300 Americans between ages 18 and 29 from various ethnic groups, social classes, and geographical regions (**Arnett, 2004**). To what extent does the theory of emerging adulthood apply internationally?

The answer to this question depends greatly on what part of the world is considered. Demographers make a useful distinction between the non-industrialized countries that comprise the majority of the world's population and the industrialized countries that are part of the Organization for Economic Co-operation and Development (OECD), including the United States, Canada, western Europe, Japan, South Korea, Australia, and New Zealand. The current population of **OECD countries** (also called **industrialized countries**) is 1.2 billion,

about 18% of the total world population (**UNDP, 2011**). The rest of the human population resides in **non-industrialized countries**, which have much lower median incomes; much lower median educational attainment; and much higher incidence of illness, disease, and early death. Let us consider emerging adulthood in OECD countries first, then in non-industrialized countries.



Map of OECD countries. Darker shaded countries are original members. [Image: Parastscilveks, <https://goo.gl/Mlvm0Y>, CC BY-SA 2.0, <https://goo.gl/eH69he>]

EA in OECD Countries: The Advantages of Affluence

The same demographic changes as described above for the United States have taken place in other OECD countries as well. This is true of participation in postsecondary education as well as median ages for entering marriage and parenthood (**UNdata, 2010**). However, there is also substantial variability in how emerging adulthood is experienced across OECD countries. Europe is the region where emerging adulthood is longest and most leisurely. The median ages for entering

marriage and parenthood are near 30 in most European countries (**Douglass, 2007**). Europe today is the location of the most affluent, generous, and egalitarian societies in the world—in fact, in human history (**Arnett, 2007**). Governments pay for **tertiary education**, assist young people in finding jobs, and provide generous unemployment benefits for those who cannot find work. In northern Europe, many governments also provide housing support. Emerging adults in European societies make the most of these advantages, gradually making their way to adulthood during their twenties while enjoying travel and leisure with friends.

The lives of Asian emerging adults in industrialized countries such as Japan and South Korea are in some ways similar to the lives of emerging adults in Europe and in some ways strikingly different. Like European emerging adults, Asian emerging adults tend to enter marriage and parenthood around age 30 (**Arnett, 2011**). Like European emerging adults, Asian emerging adults in Japan and South Korea enjoy the benefits of living in affluent societies with generous social welfare systems that provide support for them in making the transition to adulthood—for example, free university education and substantial unemployment benefits.

However, in other ways, the experience of emerging adulthood in Asian OECD countries is markedly different than in Europe. Europe has a long history of **individualism**, and today's emerging adults carry that legacy with them in their focus on self-development and leisure during emerging adulthood. In contrast, Asian cultures have a shared cultural history emphasizing **collectivism** and family obligations. Although Asian cultures have become more individualistic in recent decades as a consequence of globalization, the legacy of collectivism persists in the lives of emerging adults. They pursue identity explorations and self-development during emerging adulthood, like their American and European counterparts, but within narrower boundaries set by their

sense of obligations to others, especially their parents (**Phinney & Baldelomar, 2011**). For example, in their views of the most important criteria for becoming an adult, emerging adults in the United States and Europe consistently rank *financial independence* among the most important markers of adulthood. In contrast, emerging adults with an Asian cultural background especially emphasize becoming *capable of supporting parents financially* as among the most important criteria (**Arnett, 2003; Nelson, Badger, & Wu, 2004**). This sense of family obligation may curtail their identity explorations in emerging adulthood to some extent, as they pay more heed to their parents' wishes about what they should study, what job they should take, and where they should live than emerging adults do in the West (**Rosenberger, 2007**).

Another notable contrast between Western and Asian emerging adults is in their sexuality. In the West, premarital sex is normative by the late teens, more than a decade before most people enter marriage. In the United States and Canada, and in northern and eastern Europe, cohabitation is also normative; most people have at least one cohabiting partnership before marriage. In southern Europe, cohabiting is still taboo, but premarital sex is tolerated in emerging adulthood. In contrast, both premarital sex and cohabitation remain rare and forbidden throughout Asia. Even dating is discouraged until the late twenties, when it would be a prelude to a serious relationship leading to marriage. In cross-cultural comparisons, about three fourths of emerging adults in the United States and Europe report having had premarital sexual relations by age 20, versus less than one fifth in Japan and South Korea (**Hatfield and Rapson, 2006**).

EA in Non-Industrialized Countries: Low But Rising

Emerging adulthood is well established as a normative life stage in the industrialized countries described thus far, but it is still growing in non-industrialized countries. Demographically, in non-industrialized countries as in OECD countries, the median ages for entering marriage and parenthood have been rising in recent decades, and an increasing proportion of young people have obtained post-secondary education. Nevertheless, currently it is only a minority of young people in non-industrialized countries who experience anything resembling emerging adulthood. The majority of the population still marries around age 20 and has long finished education by the late teens. As you can see in Figure 1, rates of enrollment in tertiary education are much lower in non-industrialized countries (represented by the five countries on the right) than in OECD countries (represented by the five countries on the left).

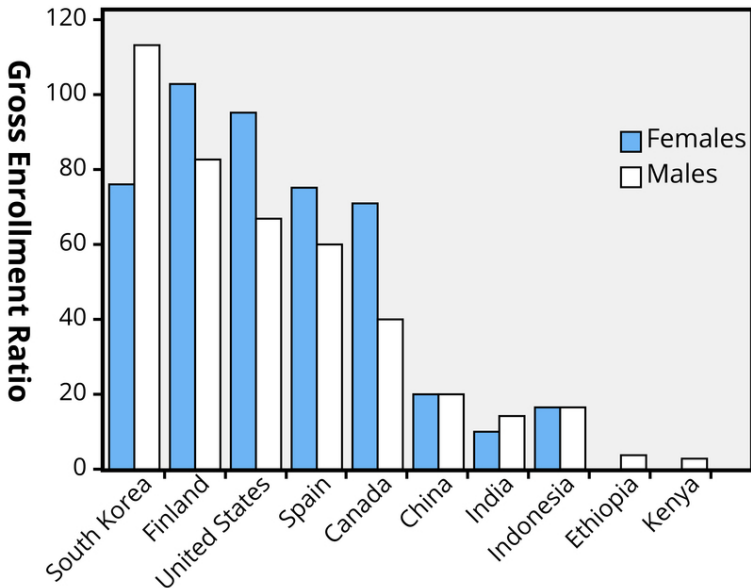


Figure 1: Gross tertiary enrollment, selected countries, 2007. Source: UNdata (2010). Note. Gross enrollment ratio is the total enrollment in a specific level of education, regardless of age, expressed as a percentage of the eligible official school-age population corresponding to the same level of education in a given school year. For the tertiary level, the population used is that of the five-year age group following the end of secondary schooling.

For young people in non-industrialized countries, emerging adulthood exists only for the wealthier segment of society, mainly the urban middle class, whereas the rural and urban poor—the majority of the population—have no emerging adulthood and may even have no adolescence because they enter adult-like work at an early age and also begin marriage and parenthood relatively early. What Saraswathi and Larson (2002) observed about adolescence applies to emerging adulthood as well: “In many ways, the lives of middle-class youth in India, South East Asia, and Europe have more in common with each other than they do with those of poor

youth in their own countries.” However, as globalization proceeds, and economic development along with it, the proportion of young people who experience emerging adulthood will increase as the middle class expands. By the end of the 21st century, emerging adulthood is likely to be normative worldwide.

Conclusion



College and other educational opportunities are important for emerging adults to help transition successfully to the next stages of their lives. [Image: Jirka Matousek, <https://goo.gl/WliY5W>, CC BY 2.0, <https://goo.gl/BRvSA7>]

The new life stage of emerging adulthood has spread rapidly in the past half-century and is continuing to spread. Now that the transition to adulthood is later than in the past, is this change positive or negative for emerging adults and their societies? Certainly there are some negatives. It means that young people are dependent on their parents for longer than in the past, and they take longer to become full contributing members of

their societies. A substantial proportion of them have trouble sorting through the opportunities available to them and struggle with anxiety and depression, even though most are optimistic. However, there are advantages to having this new life stage as well. By waiting until at least their late twenties to take on the full range of adult responsibilities, emerging adults are able to focus on obtaining enough education and training to prepare themselves for the demands of today's information-

and technology-based economy. Also, it seems likely that if young people make crucial decisions about love and work in their late twenties or early thirties rather than their late teens and early twenties, their judgment will be more mature and they will have a better chance of making choices that will work out well for them in the long run.

What can societies do to enhance the likelihood that emerging adults will make a successful transition to adulthood? One important step would be to expand the opportunities for obtaining tertiary education. The tertiary education systems of OECD countries were constructed at a time when the economy was much different, and they have not expanded at the rate needed to serve all the emerging adults who need such education. Furthermore, in some countries, such as the United States, the cost of tertiary education has risen steeply and is often unaffordable to many young people. In non-industrialized countries, tertiary education systems are even smaller and less able to accommodate their emerging adults. Across the world, societies would be wise to strive to make it possible for every emerging adult to receive tertiary education, free of charge. There could be no better investment for preparing young people for the economy of the future.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You

can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Collectivism

Belief system that emphasizes the duties and obligations that each person has toward others.

Emerging adulthood

A new life stage extending from approximately ages 18 to 25, during which the foundation of an adult life is gradually constructed in love and work. Primary features include identity explorations, instability, focus on self-development, feeling incompletely adult, and a broad sense of possibilities.

Individualism

Belief system that exalts freedom, independence, and individual choice as high values.

Industrialized countries

The economically advanced countries of the world, in which most of the world's wealth is concentrated.

Non-industrialized countries

The less economically advanced countries that comprise the majority of the world's population. Most are currently developing at a rapid rate.

OECD countries Members of the Organization for Economic Co-operation and Development, comprised of the world's wealthiest countries. **Tertiary education** Education or training beyond secondary school, usually taking place in a college, university, or vocational training program.

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44. Aging

Original chapter by Tara Queen and Jacqui Smith adapted by the Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

Traditionally, research on aging described only the lives of people over age 65 and the very old. Contemporary theories and research recognizes that biogenetic and psychological processes of aging are complex and lifelong. Functioning in each period of life is influenced by what happened earlier and, in turn, affects subsequent change. We all age in specific social and historical contexts. Together, these multiple influences on aging make it difficult to define when middle-age or old age begins. This module describes central concepts and research about adult development and aging. We consider contemporary questions about cognitive aging and changes in personality, self-related beliefs, social relationships, and subjective well-being. These four aspects of psychosocial aging are related to health and longevity

Learning Objectives

- Explain research approaches to studying aging.

- Describe cognitive, psychosocial, and physical changes that occur with age.
- Provide examples of how age-related changes in these domains are observed in the context of everyday life.

Introduction



Due to positive health trends the population of older adults is increasing steadily. Understanding the psychology of aging will be more important than ever to support this group and help them thrive. [Photo: Woody Hibbard, <https://goo.gl/VP7pfz>, CC BY 2.0, <https://goo.gl/JD0cjf>]

We are currently living in an aging society (**Rowe, 2009**). Indeed, by 2030 when the last of the Baby Boomers reach age 65, the U.S. older population will be double that of 2010. Furthermore, because of increases in average life expectancy, each new generation can expect to live longer than their parents' generation and certainly longer than their grandparents' generation. As a consequence, it is time for individuals of all ages to rethink their personal life plans and consider prospects

for a long life. When is the best time to start a family? Will the education gained up to age 20 be sufficient to cope with future technological advances and marketplace needs? What is the right balance between work, family, and leisure throughout life? What's the best age to retire? How can I age successfully and enjoy life to the fullest when I'm 80 or 90? In this module we will discuss several different domains of psychological research on aging that will help answer these important questions.

Overview: Life Span and Life Course Perspectives on Aging

Just as young adults differ from one another, older adults are also not all the same. In each decade of adulthood, we observe substantial **heterogeneity** in cognitive functioning, personality, social relationships, lifestyle, beliefs, and satisfaction with life. This heterogeneity reflects differences in rates of biogenetic and psychological aging and the sociocultural contexts and history of people's lives (Bronfenbrenner, **1979**; Fingerman, Berg, Smith, & Antonucci, **2011**). Theories of aging describe how these multiple factors interact and change over time. They describe why functioning differs on average between young, middle-aged, young-old, and very old adults and why there is heterogeneity within these age groups. **Life course theories**, for example, highlight the effects of social expectations and the normative timing of life events and social roles (e.g., becoming a parent, retirement). They also consider the lifelong cumulative effects of membership in specific **cohorts** (generations) and sociocultural subgroups (e.g., race, gender, socioeconomic status) and exposure to historical events (e.g., war, revolution, natural disasters; Elder, Johnson, & Crosnoe, **2003**; Settersten, **2005**). **Life span theories** complement the life-course perspective with a greater focus on processes within the individual (e.g., the aging brain). This approach emphasizes the patterning of lifelong **intra- and inter-individual differences** in the shape (gain, maintenance, loss), level, and rate of change (Baltes, **1987, 1997**). Both life course and life span researchers generally rely on **longitudinal studies** to examine hypotheses about different patterns of aging associated with the effects of biogenetic, life history, social, and personal factors. **Cross-sectional studies** provide information about age-group differences, but these are confounded with cohort, time of study, and historical effects.

Cognitive Aging

Researchers have identified areas of both losses and gains in cognition in older age. Cognitive ability and intelligence are often measured using standardized tests and validated measures. The **psychometric approach** has identified two categories of intelligence that show different rates of change across the life span (**Schaie & Willis, 1996**). **Fluid intelligence** refers to information processing abilities, such as logical reasoning, remembering lists, spatial ability, and reaction time. **Crystallized intelligence** encompasses abilities that draw upon experience and knowledge. Measures of crystallized intelligence include vocabulary tests, solving number problems, and understanding texts.

With age, systematic declines are observed on cognitive tasks requiring self-initiated, effortful processing, without the aid of supportive memory cues (**Park, 2000**). Older adults tend to perform poorer than young adults on memory tasks that involve **recall** of information, where individuals must retrieve information they learned previously without the help of a list of possible choices. For example, older adults may have more difficulty recalling facts such as names or contextual details about where or when something happened (**Craik, 2000**). What might explain



There are many stereotypes of older adults. They are sometimes seen as slow because of changes in cognitive processing speed. They are though, on average, excellent at drawing on personal experience and knowledge. And they tend to outperform young adults when it comes to social and emotional challenges. [Image: Alex E. Proimos, <https://goo.gl/20SbW8>, CC BY-NC 2.0, <https://goo.gl/F1lc2e>]

these deficits as we age? As we age, **working memory**, or our ability to simultaneously store and use information, becomes less efficient (**Craik & Bialystok, 2006**). The ability to process information quickly also decreases with age. This slowing of **processing speed** may explain age differences on many different cognitive tasks (**Salthouse, 2004**). Some researchers have argued that **inhibitory functioning**, or the ability to focus on certain information while suppressing attention to less pertinent information, declines with age and may explain age differences in performance on cognitive tasks (**Hasher & Zacks, 1988**). Finally, it is well established that our hearing and vision decline as we age. Longitudinal research has proposed that deficits in sensory functioning explain age differences in a variety of cognitive abilities (**Baltes & Lindenberger, 1997**).

Fewer age differences are observed when memory cues are available, such as for **recognition** memory tasks, or when individuals can draw upon acquired knowledge or experience. For example, older adults often perform as well if not better than young adults on tests of word knowledge or vocabulary. With age often comes expertise, and research has pointed to areas where aging experts perform as well or better than younger individuals. For example, older typists were found to compensate for age-related declines in speed by looking farther ahead at printed text (**Salthouse, 1984**). Compared to younger players, older chess experts are able to focus on a smaller set of possible moves, leading to greater cognitive efficiency (**Charness, 1981**). Accrued knowledge of everyday tasks, such as grocery prices, can help older adults to make better decisions than young adults (**Tentori, Osheron, Hasher, & May, 2001**).

How do changes or maintenance of cognitive ability affect older adults' everyday lives? Researchers have studied cognition in the context of several different everyday activities. One example is driving. Although older adults often have more years of driving experience, cognitive declines related to

reaction time or attentional processes may pose limitations under certain circumstances (**Park & Gutches, 2000**). Research on interpersonal problem solving suggested that older adults use more effective strategies than younger adults to navigate through social and emotional problems (**Blanchard-Fields, 2007**). In the context of work, researchers rarely find that older individuals perform poorer on the job (**Park & Gutches, 2000**). Similar to everyday problem solving, older workers may develop more efficient strategies and rely on expertise to compensate for cognitive decline.

Personality and Self-Related Processes

Research on adult personality examines normative age-related increases and decreases in the expression of the so-called “Big Five” traits—extraversion, neuroticism, conscientiousness, agreeableness, and openness to new experience. Does personality change throughout adulthood? Previously the answer was no, but contemporary research shows that although some people’s personalities are relatively stable over time, others’ are not (**Lucas & Donnellan, 2011; Roberts & Mroczek, 2008**). Longitudinal studies reveal average changes during adulthood in the expression of some traits (e.g., neuroticism and openness decrease with age and conscientiousness increases) and individual differences in these patterns due to idiosyncratic life events (e.g., divorce, illness). Longitudinal research also suggests that adult personality traits, such as conscientiousness, predict important life outcomes including job success, health, and longevity (Friedman, Tucker, Tomlinson-Keasey, Schwartz, Wingard, & Criqui, **1993**; Roberts, Kuncel, Shiner, Caspi, & Goldberg, **2007**).

In contrast to the relative stability of personality traits, theories about the aging self-propose changes in self-related knowledge, beliefs, and **autobiographical narratives**.

Responses to questions such as “Tell me something about yourself. Who are you?” “What are your hopes for the future?” provide insight into the characteristics and life themes that an individual considers uniquely distinguish him or herself from others. These self-descriptions enhance self-esteem and guide behavior (Markus & Nurius, 1986; McAdams, 2006). Theory suggests that as we age, themes that were relatively unimportant in young and middle adulthood gain in salience (e.g., generativity, health) and that people view themselves as improving over time (Ross & Wilson, 2003). Reorganizing personal life narratives and self-descriptions are the major tasks of midlife and young-old age due to transformations in professional and family roles and obligations. In advanced old age, self-descriptions are often characterized by a life review and reflections about having lived a long life. Birren and Schroots (2006), for example, found the process of life review in late life helped individuals confront and cope with the challenges of old age.



There is a difference between physical age and subjective age as summarized in the saying “You are only as old as you feel.” [Image: Emar, CC BY-NC-SA 2.0, <https://goo.gl/HEXbAA>]

One aspect of the self that particularly interests life span and life course psychologists is the individual's perception and evaluation of their own aging and identification with an age group. **Subjective age** is a multidimensional construct that indicates how old (or young) a person feels and into which age group a person categorizes him- or herself. After early adulthood, most people say that they feel younger than their chronological age and the

gap between subjective age and actual age generally

increases. On average, after age 40 people report feeling 20% younger than their actual age (e.g., **Rubin & Berntsen, 2006**). Asking people how satisfied they are with their own aging assesses an evaluative component of **age identity**. Whereas some aspects of age identity are positively valued (e.g., acquiring seniority in a profession or becoming a grandparent), others may be less valued, depending on societal context. Perceived physical age (i.e., the age one looks in a mirror) is one aspect that requires considerable self-related adaptation in social and cultural contexts that value young bodies. Feeling younger and being satisfied with one's own aging are expressions of positive **self-perceptions of aging**. They reflect the operation of self-related processes that enhance well-being. Levy (**2009**) found that older individuals who are able to adapt to and accept changes in their appearance and physical capacity in a positive way report higher well-being, have better health, and live longer.

Social Relationships

Social ties to family, friends, mentors, and peers are primary resources of information, support, and comfort. Individuals develop and age together with family and friends and interact with others in the community. Across the life course, social ties are accumulated, lost, and transformed. Already in early life, there are multiple sources of heterogeneity in the characteristics of each person's **social network** of relationships (e.g., size, composition, and quality). Life course and life span theories and research about age-related patterns in social relationships focus on understanding changes in the processes underlying social connections. Antonucci's **Convoy Model of Social Relations** (**2001**; Kahn & Antonucci, **1980**), for example, suggests that the social connections that people accumulate are held together by exchanges in social support (e.g., tangible

and emotional). The frequency, types, and reciprocity of the exchanges change with age and in response to need, and in turn, these exchanges impact the health and well-being of the givers and receivers in the convoy. In many relationships, it is not the actual objective exchange of support that is critical but instead the perception that support is available if needed (Uchino, 2009). Carstensen's **Socioemotional Selectivity Theory** (1993; Carstensen, Isaacowitz, & Charles, 1999) focuses on changes in motivation for actively seeking social contact with others. She proposes that with increasing age our motivational goals change from information gathering to emotion regulation. To optimize the experience of positive affect, older adults actively restrict their social life to prioritize time spent with emotionally close significant others. In line with this, older marriages are found to be characterized by enhanced positive and reduced negative interactions and older partners show more affectionate behavior during conflict discussions than do middle-aged partners (Carstensen, Gottman, & Levenson, 1995). Research showing that older adults have smaller networks compared to young adults and tend to avoid negative interactions also supports this theory. Similar selective processes are also observed when time horizons for interactions with close partners shrink temporarily for young adults (e.g., impending geographical separations).

Much research focuses on the associations between specific effects of long-term social relationships and health in later life. Older married individuals who receive positive social and emotional support from their partner generally report better health than their unmarried peers (Antonucci, 2001; Umberson, Williams, Powers, Liu, & Needham, 2006; Waite & Gallagher, 2000). Despite the overall positive health effects of being married in old age (compared with being widowed, divorced, or single), living as a couple can have a "dark side" if the relationship is strained or if one partner is the primary caregiver. The consequences of positive and negative aspects

of relationships are complex (**Birditt & Antonucci, 2008; Rook, 1998; Uchino, 2009**). For example, in some circumstances, criticism from a partner may be perceived as valid and useful feedback whereas in others it is considered unwarranted and hurtful. In long-term relationships, habitual negative exchanges might have diminished effects. Parent-child and sibling relationships are often the most long-term and emotion-laden social ties. Across the life span, the parent-child tie, for example, is characterized by a paradox of solidarity, conflict, and ambivalence (**Fingerman, Chen, Hay, Cichy, & Lefkowitz, 2006**).

Emotion and Well-being

As we get older, the likelihood of losing loved ones or experiencing declines in health increases. Does the experience of such losses result in decreases in well-being in older adulthood? Researchers have found that well-being differs across the life span and that the patterns of these differences depend on how well-being is measured.

Measures of **global subjective well-being** assess individuals' overall perceptions of their lives. This can include questions about life satisfaction or judgments of whether individuals are currently living the best life possible. What factors may contribute to how people respond to these questions? Age, health, personality, social support, and life experiences have been shown to influence judgments of global well-being. It is important to note that predictors of well-being may change as we age. What is important to life satisfaction in young adulthood can be different in later adulthood (**George, 2010**). Early research on well-being argued that life events such as marriage or divorce can temporarily influence well-being, but people quickly adapt and return to a neutral baseline (called the hedonic treadmill; **Diener, Lucas, & Scollon, 2006**). More

recent research suggests otherwise. Using longitudinal data, researchers have examined well-being prior to, during, and after major life events such as widowhood, marriage, and unemployment (**Lucas, 2007**). Different life events influence well-being in different ways, and individuals do not often adapt back to baseline levels of well-being. The influence of events, such as unemployment, may have a lasting negative influence on well-being as people age. Research suggests that global well-being is highest in early and later adulthood and lowest in midlife (**Stone, Schwartz, Broderick, & Deaton, 2010**).

Hedonic well-being refers to the emotional component of well-being and includes measures of positive (e.g., happiness, contentment) and negative affect (e.g., stress, sadness). The pattern of positive affect across the adult life span is similar to that of global well-being, with experiences of positive emotions such as happiness and enjoyment being highest in young and older adulthood. Experiences of negative affect, particularly stress and anger, tend to decrease with age. Experiences of sadness are lowest in early and later adulthood compared to midlife (**Stone et al., 2010**). Other research finds that older adults report more positive and less negative affect than middle age and younger adults (**Magai, 2008; Mroczek, 2001**). It should be noted that both global well-being and positive affect tend to taper off during late older adulthood and these declines may be accounted for by increases in health-related losses during these years (**Charles & Carstensen, 2010**).

Psychological well-being aims to evaluate the positive aspects of psychosocial development, as opposed to factors of ill-being, such as depression or anxiety. Ryff's model of psychological well-being proposes six core dimensions of positive well-being. Older adults tend to report higher environmental mastery (feelings of competence and control in managing everyday life) and autonomy (independence), lower personal growth and purpose in life, and similar levels of positive relations with others as younger individuals (**Ryff,**

1995). Links between health and interpersonal flourishing, or having high-quality connections with others, may be important in understanding how to optimize quality of life in old age (Ryff & Singer, 2000).

Successful Aging and Longevity



Physical activity is one of the pillars of successful aging. [Image: William Murphy, <https://goo.gl/Khsbsb>, CC BY-SA 2.0, <https://goo.gl/jSSrcO>]

Increases in **average life expectancy** in the 20th century and evidence from twin studies that suggests that genes account for only 25% of the variance in human life spans have opened new questions about implications for individuals and society (Christensen, Doblhammer, Rau, & Vaupel, 2009). What environmental and behavioral factors contribute to a healthy long life? Is it possible to intervene to slow

processes of aging or to minimize cognitive decline, prevent dementia, and ensure life quality at the end of life (Fratiglioni, Paillard-Borg, & Winblad, 2004; Hertzog, Kramer, Wilson, & Lindenberger, 2009; Lang, Baltes, & Wagner, 2007)? Should interventions focus on late life, midlife, or indeed begin in early life? Suggestions that pathological change (e.g., dementia) is not an inevitable component of aging and that pathology could at least be delayed until the very end of life led to theories about **successful aging** and proposals about targets for intervention. Rowe and Kahn (1997) defined three criteria of successful aging: (a) the relative avoidance of disease, disability, and risk factors like high blood pressure, smoking, or obesity;

(b) the maintenance of high physical and cognitive functioning; and (c) active engagement in social and productive activities. Although such definitions of successful aging are value-laden, research and behavioral interventions have subsequently been guided by this model. For example, research has suggested that age-related declines in cognitive functioning across the adult life span may be slowed through physical exercise and lifestyle interventions (Kramer & Erickson, **2007**). It is recognized, however, that societal and environmental factors also play a role and that there is much room for social change and technical innovation to accommodate the needs of the Baby Boomers and later generations as they age in the next decades.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Age identity

How old or young people feel compared to their chronological age; after early adulthood, most people feel younger than their chronological age.

Autobiographical narratives

A qualitative research method used to understand characteristics and life themes that an individual considers to uniquely distinguish him- or herself from others.

Average life expectancy

Mean number of years that 50% of people in a specific birth cohort are expected to survive. This is typically calculated from birth but is also sometimes re-calculated

for people who have already reached a particular age (e.g., 65).

Cohort

Group of people typically born in the same year or historical period, who share common experiences over time; sometimes called a generation (e.g., Baby Boom Generation).

Convoy Model of Social Relations

Theory that proposes that the frequency, types, and reciprocity of social exchanges change with age. These social exchanges impact the health and well-being of the givers and receivers in the convoy.

Cross-sectional studies

Research method that provides information about age group differences; age differences are confounded with cohort differences and effects related to history and time of study.

Crystallized intelligence

Type of intellectual ability that relies on the application of knowledge, experience, and learned information.

Fluid intelligence

Type of intelligence that relies on the ability to use information processing resources to reason logically and solve novel problems.

Global subjective well-being

Individuals' perceptions of and satisfaction with their lives as a whole.

Hedonic well-being

Component of well-being that refers to emotional experiences, often including measures of positive (e.g., happiness, contentment) and negative affect (e.g., stress,

sadness).

Heterogeneity

Inter-individual and subgroup differences in level and rate of change over time.

Inhibitory functioning

Ability to focus on a subset of information while suppressing attention to less relevant information.

Intra- and inter-individual differences

Different patterns of development observed within an individual (intra-) or between individuals (inter-).

Life course theories

Theory of development that highlights the effects of social expectations of age-related life events and social roles; additionally considers the lifelong cumulative effects of membership in specific cohorts and sociocultural subgroups and exposure to historical events.

Life span theories

Theory of development that emphasizes the patterning of lifelong within- and between-person differences in the shape, level, and rate of change trajectories.

Longitudinal studies

Research method that collects information from individuals at multiple time points over time, allowing researchers to track cohort differences in age-related change to determine cumulative effects of different life experiences.

Processing speed

The time it takes individuals to perform cognitive operations (e.g., process information, react to a signal, switch attention from one task to another, find a specific target object in a complex picture).

Psychometric approach

Approach to studying intelligence that examines performance on tests of intellectual functioning.

Recall

Type of memory task where individuals are asked to remember previously learned information without the help of external cues.

Recognition

Type of memory task where individuals are asked to remember previously learned information with the assistance of cues.

Self-perceptions of aging

An individual's perceptions of their own aging process; positive perceptions of aging have been shown to be associated with greater longevity and health.

Social network

Network of people with whom an individual is closely connected; social networks provide emotional, informational, and material support and offer opportunities for social engagement.

Socioemotional Selectivity Theory

Theory proposed to explain the reduction of social partners in older adulthood; posits that older adults focus on meeting emotional over information-gathering goals, and adaptively select social partners who meet this need.

Subjective age

A multidimensional construct that indicates how old (or young) a person feels and into which age group a person categorizes him- or herself

Successful aging

Includes three components: avoiding disease, maintaining

high levels of cognitive and physical functioning, and having an actively engaged lifestyle.

Working memory

Memory system that allows for information to be simultaneously stored and utilized or manipulated.

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PSYC 100 XVI

INTELLIGENCE AND DECISION MAKING

45. Intelligence

Original chapter by Robert Biswas-Diener
adapted by the Queen's University
Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

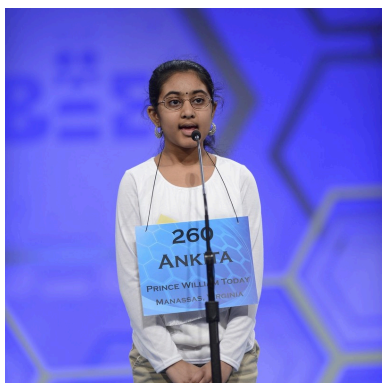
Intelligence is among the oldest and longest studied topics in all of psychology. The development of assessments to measure this concept is at the core of the development of psychological science itself. This module introduces key historical figures, major theories of intelligence, and common assessment strategies related to intelligence. This module will also discuss controversies related to the study of group differences in intelligence.

Learning Objectives

- List at least two common strategies for measuring intelligence.
- Name at least one “type” of intelligence.
- Define intelligence in simple terms.
- Explain the controversy relating to differences in intelligence between groups.

Introduction

Every year hundreds of grade school students converge on Washington, D.C., for the annual Scripps National Spelling Bee. The “bee” is an elite event in which children as young as 8 square off to spell words like “cymotrichous” and “appoggiatura.” Most people who watch the bee think of these kids as being “smart” and you likely agree with this description.



A participant in the Scripps National Spelling Bee. [Image: Scripps National Spelling Bee, <https://goo.gl/94Hgbm>, CC BY-NC 2.0, <https://goo.gl/VnKlK8>]

What makes a person intelligent? Is it heredity (two of the 2014 contestants in the bee have siblings who have previously won)(**National Spelling Bee, 2014a**)? Is it interest (the most frequently listed favorite subject among spelling bee competitors is math)(**NSB, 2014b**)? In this module we will cover these and other fascinating aspects of **intelligence**. By the end of the module you should be able to define intelligence

and discuss some common strategies for measuring intelligence. In addition, we will tackle the politically thorny issue of whether there are differences in intelligence between groups such as men and women.

Defining and Measuring Intelligence

When you think of “smart people” you likely have an intuitive sense of the qualities that make them intelligent. Maybe you think they have a good memory, or that they can think quickly,

or that they simply know a whole lot of information. Indeed, people who exhibit such qualities appear very intelligent. That said, it seems that intelligence must be more than simply knowing facts and being able to remember them. One point in favor of this argument is the idea of animal intelligence. It will come as no surprise to you that a dog, which can learn commands and tricks seems smarter than a snake that cannot. In fact, researchers and lay people generally agree with one another that primates—monkeys and apes (including humans)—are among the most intelligent animals. Apes such as chimpanzees are capable of complex problem solving and sophisticated communication (**Kohler, 1924**).

Scientists point to the social nature of primates as one evolutionary source of their intelligence. Primates live together in troops or family groups and are, therefore, highly social creatures. As such, primates tend to have brains that are better developed for communication and long term thinking than most other animals. For instance, the complex social environment has led primates to develop deception, altruism, numerical concepts, and “theory of mind” (a sense of the self as a unique individual separate from others in the group; **Gallup, 1982; Hauser, MacNeilage & Ware, 1996**).[Also see module Theory of Mind]

The question of what constitutes human intelligence is one of the oldest inquiries in psychology. When we talk about intelligence we typically mean intellectual ability. This broadly encompasses the ability to learn, remember and use new information, to solve problems and to adapt to novel situations. An early scholar of intelligence, Charles Spearman, proposed the idea that intelligence was one thing, a “general factor” sometimes known as simply “**g**.” He based this conclusion on the observation that people who perform well in one intellectual area such as verbal ability also tend to perform well in other areas such as logic and reasoning (**Spearman, 1904**).

A contemporary of Spearman’s named Francis

Galton—himself a cousin of Charles Darwin— was among those who pioneered psychological measurement (**Hunt, 2009**). For three pence Galton would measure various physical characteristics such as grip strength but also some psychological attributes such as the ability to judge distance or discriminate between colors. This is an example of one of the earliest systematic measures of individual ability. Galton was particularly interested in intelligence, which he thought was heritable in much the same way that height and eye color are. He conceived of several rudimentary methods for assessing whether his hypothesis was true. For example, he carefully tracked the family tree of the top-scoring Cambridge students over the previous 40 years. Although he found specific families disproportionately produced top scholars, intellectual achievement could still be the product of economic status, family culture or other non-genetic factors. Galton was also, possibly, the first to popularize the idea that the heritability of psychological traits could be studied by looking at identical and fraternal twins. Although his methods were crude by modern standards, Galton established intelligence as a variable that could be measured (**Hunt, 2009**).



*Intelligence research pioneer
Alfred Binet*

The person best known for formally pioneering the measurement of intellectual ability is Alfred Binet. Like Galton, Binet was fascinated by individual differences in intelligence. For instance, he blindfolded chess players and saw that some of them had the ability to continue playing using only their memory to keep the many positions of the pieces in mind (**Binet, 1894**). Binet was particularly interested in the development of intelligence,

a fascination that led him to observe children carefully in the classroom setting.

Along with his colleague Theodore Simon, Binet created a test of children's intellectual capacity. They created individual test items that should be answerable by children of given ages. For instance, a child who is three should be able to point to her mouth and eyes, a child who is nine should be able to name the months of the year in order, and a twelve year old ought to be able to name sixty words in three minutes. Their assessment became the first "IQ test."

1. Which of the following is the most similar to 1313323?

- A. ACACCB
- B. CACAABC
- C. ABABBCA
- D. ACACDC

2. Jenny has some chocolates. She eats two and gives half of the remainder to Lisa. If Lisa has six chocolates how many does Jenny have in the beginning?

- A. 6
- B. 12
- C. 14
- D. 18

3. Which of the following items is not like the others in the list?

duck, raft, canoe, stone, rubber ball

- A. Duck
- B. Canoe
- C. Stone
- D. Rubber ball

4. What do steam and ice have in common?

- A. They can both harm skin
- B. They are both made from water
- C. They are both found in the kitchen
- D. They are both the products of water at extreme temperatures

Answers: 1) A; 2) C; 3) stone; 4) D is the most sophisticated answer

Table 1: Examples of the types of items you might see on an intelligence test.

“IQ” or “intelligence quotient” is a name given to the score of the Binet-Simon test. The score is derived by dividing a child’s mental age (the score from the test) by their chronological age to create an overall quotient. These days, the phrase “IQ” does not apply specifically to the Binet-Simon test and is used to generally denote intelligence or a score on any intelligence test. In the early 1900s the Binet-Simon test was adapted by a Stanford professor named Lewis Terman to create what is, perhaps, the most famous intelligence test in the world, the Stanford-Binet (**Terman, 1916**). The major advantage of this new test was that it was **standardized**. Based on a large sample of children Terman was able to plot the scores in a normal distribution, shaped like a “bell curve” (see Fig. 1). To understand a normal distribution think about the height of people. Most people are average in height with relatively fewer being tall or short, and fewer still being extremely tall or extremely short. Terman (**1916**) laid out intelligence scores in exactly the same way, allowing for easy and reliable categorizations and comparisons between individuals.

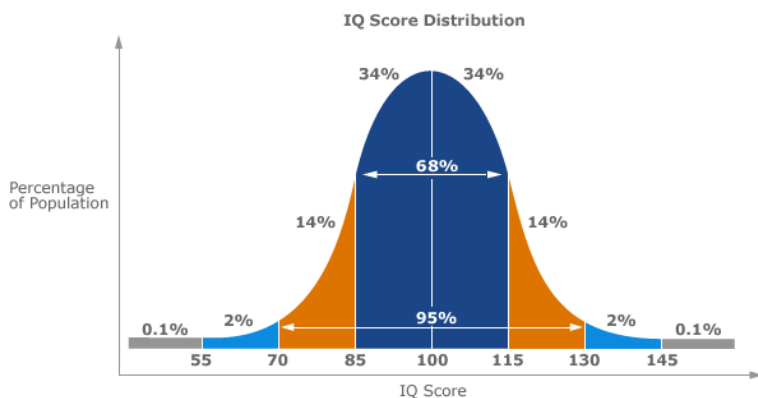


Figure 1: Bell Curve – Normal Distribution IQ

Looking at another modern intelligence test—the Wechsler

Adult Intelligence Scale (WAIS)—can provide clues to a definition of intelligence itself. Motivated by several criticisms of the Stanford-Binet test, psychologist David Wechsler sought to create a superior measure of intelligence. He was critical of the way that the Stanford-Binet relied so heavily on verbal ability and was also suspicious of using a single score to capture all of intelligence. To address these issues Wechsler created a test that tapped a wide range of intellectual abilities. This understanding of intelligence—that it is made up of a pool of specific abilities—is a notable departure from Spearman's concept of general intelligence. The WAIS assesses people's ability to remember, compute, understand language, reason well, and process information quickly (**Wechsler, 1955**).

One interesting by-product of measuring intelligence for so many years is that we can chart changes over time. It might seem strange to you that intelligence can change over the decades but that appears to have happened over the last 80 years we have been measuring this topic. Here's how we know: IQ tests have an average score of 100. When new waves of people are asked to take older tests they tend to outperform the original sample from years ago on which the test was **normed**. This gain is known as the "Flynn Effect," named after James Flynn, the researcher who first identified it (**Flynn, 1987**). Several hypotheses have been put forth to explain the Flynn Effect including better nutrition (healthier brains!), greater familiarity with testing in general, and more exposure to visual stimuli. Today, there is no perfect agreement among psychological researchers with regards to the causes of increases in average scores on intelligence tests. Perhaps if you choose a career in psychology you will be the one to discover the answer!

Types of Intelligence

David Wechsler's approach to testing intellectual ability was based on the fundamental idea that there are, in essence, many aspects to intelligence. Other scholars have echoed this idea by going so far as to suggest that there are actually even different types of intelligence. You likely have heard distinctions made between "street smarts" and "book learning." The former refers to practical wisdom accumulated through experience while the latter indicates formal education. A person high in street smarts might have a superior ability to catch a person in a lie, to persuade others, or to think quickly under pressure. A person high in book learning, by contrast, might have a large vocabulary and be able to remember a large number of references to classic novels. Although psychologists don't use street smarts or book smarts as professional terms they do believe that intelligence comes in different types.

There are many ways to parse apart the concept of intelligence. Many scholars believe that Carroll's (1993) review of more than 400 data sets provides the best currently existing single source for organizing various concepts related to intelligence. Carroll divided intelligence into three levels, or strata, descending from the most abstract down to the most specific (see Fig. 2). To understand this way of categorizing simply think of a "car." Car is a general word that denotes all types of motorized vehicles. At the more specific level under "car" might be various types of cars such as sedans, sports cars, SUVs, pick-up trucks, station wagons, and so forth. More specific still would be certain models of each such as a Honda Civic or Ferrari Enzo. In the same manner, Carroll called the highest level (stratum III) the general intelligence factor "g." Under this were more specific stratum II categories such as fluid intelligence and visual perception and processing speed. Each of these, in turn, can be sub-divided into very specific

components such as spatial scanning, reaction time, and word fluency.

Thinking of intelligence as Carroll (1993) does, as a collection of specific mental abilities, has helped researchers conceptualize this topic in new ways. For example, Horn and Cattell (1966) distinguish between “fluid” and “crystalized” intelligence, both of which show up on stratum II of Carroll’s model. Fluid intelligence is the ability to “think on your feet;” that is, to solve problems. Crystalized intelligence, on the other hand, is the ability to use language, skills and experience to address problems. The former is associated more with youth while the latter increases with age. You may have noticed the way in which younger people can adapt to new situations and use trial and error to quickly figure out solutions. By contrast, older people tend to rely on their relatively superior store of knowledge to solve problems.

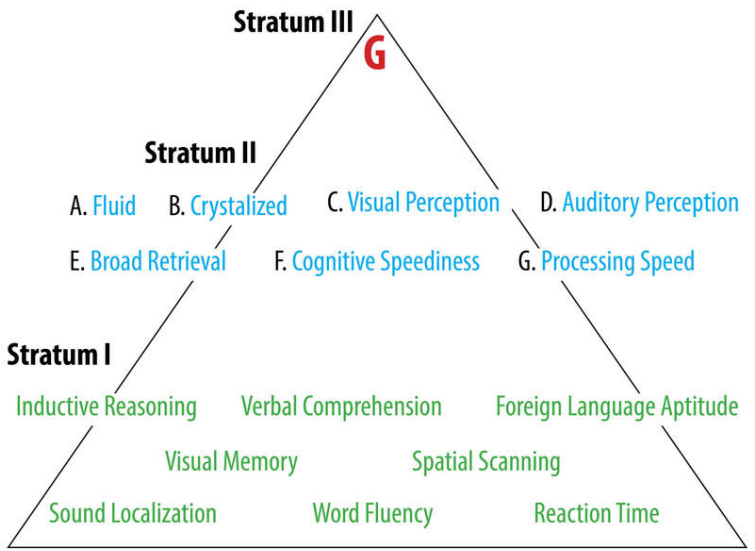


Figure 2: Carroll's Model of Intelligence

Harvard professor Howard Gardner is another figure in psychology who is well-known for championing the notion that there are different types of intelligence. Gardner's theory is appropriately, called "multiple intelligences." Gardner's theory is based on the idea that people process information through different "channels" and these are relatively independent of one another. He has identified 8 common intelligences including 1) logic-math, 2) visual-spatial, 3) music-rhythm, 4) verbal-linguistic, 5) bodily-kinesthetic, 6) interpersonal, 7) intrapersonal, and 8) naturalistic (**Gardner, 1985**). Many people are attracted to Gardner's theory because it suggests that people each learn in unique ways. There are now many Gardner- influenced schools in the world.

Another type of intelligence is Emotional intelligence. Unlike traditional models of intelligence that emphasize cognition (thinking) the idea of emotional intelligence emphasizes the experience and expression of emotion. Some researchers argue that emotional intelligence is a set of skills in which an individual can accurately understand the emotions of others, can identify and label their own emotions, and can use emotions. (**Mayer & Salovey, 1997**). Other researchers believe that emotional intelligence is a mixture of abilities, such as stress management, and personality, such as a person's predisposition for certain moods (**Bar-On, 2006**). Regardless of the specific definition of emotional intelligence, studies have shown a link between this concept and job performance (**Lopes, Grewal, Kadis, Gall, & Salovey, 2006**). In fact, emotional intelligence is similar to more traditional notions of cognitive intelligence with regards to workplace benefits. Schmidt and Hunter (**1998**), for example, reviewed research on intelligence in the workplace context and show that intelligence is the single best predictor of doing well in job training programs, of learning on the job. They also report that general intelligence is moderately correlated with all types of jobs but especially with managerial and complex, technical jobs.

There is one last point that is important to bear in mind about intelligence. It turns out that the way an individual thinks about his or her own intelligence is also important because it predicts performance. Researcher Carol Dweck has made a career out of looking at the differences between high IQ children who perform well and those who do not, so-called “under achievers.” Among her most interesting findings is that it is not gender or social class that sets apart the high and low performers. Instead, it is their mindset. The children who believe that their abilities in general—and their intelligence specifically—is a fixed trait tend to underperform. By contrast, kids who believe that intelligence is changeable and evolving tend to handle failure better and perform better (**Dweck, 1986**). Dweck refers to this as a person’s “mindset” and having a growth mindset appears to be healthier.

Correlates of Intelligence

The research on mindset is interesting but there can also be a temptation to interpret it as suggesting that every human has an unlimited potential for intelligence and that becoming smarter is only a matter of positive thinking. There is some evidence that genetics is an important factor in the intelligence equation. For instance, a number of studies on genetics in adults have yielded the result that intelligence is largely, but not totally, inherited (**Bouchard, 2004**). Having a healthy attitude about the nature of smarts and working hard can both definitely help intellectual performance but it also helps to have the genetic leaning toward intelligence.

Carol Dweck’s research on the mindset of children also brings one of the most interesting and controversial issues surrounding intelligence research to the fore: group differences. From the very beginning of the study of intelligence researchers have wondered about differences

between groups of people such as men and women. With regards to potential differences between the sexes some people have noticed that women are under-represented in certain fields. In 1976, for example, women comprised just 1% of all faculty members in engineering (**Ceci, Williams & Barnett, 2009**).



Women account for a disproportionately small percentage of those employed in math-intensive career fields such as engineering. [Photo: Argonne National Laboratory, <https://goo.gl/ix96YP>, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

Even today women make up between 3% and 15% of all faculty in math-intensive fields at the 50 top universities.

This phenomenon could be explained in many ways: it might be the result of inequalities in the educational system, it might be due to differences in socialization wherein young girls are encouraged to develop other interests, it might be the result of that women are—on

average—responsible for a

larger portion of childcare obligations and therefore make different types of professional decisions, or it might be due to innate differences between these groups, to name just a few possibilities. In a comprehensive review of research on intellectual abilities and sex, **Ceci and colleagues (2009)** argue against the hypothesis that biological and genetic differences account for much of the sex differences in intellectual ability. Instead, they believe that a complex web of influences ranging from societal expectations to test taking strategies to individual interests account for many of the sex differences found in math and similar intellectual abilities.

A question, for some, arises as to the ways in which ways

men and women might differ in intellectual ability, if at all. That is, researchers might examine the ways that men and women might differ in terms of their intellectual ability, and offer explanations for any differences that are found. Researchers have investigated sex differences in intellectual ability. Overall, much research suggests that there is no overall difference between the sexes in terms of general intelligence (e.g., **Halpern & LaMay, 2000**). There do appear to be sex differences in terms of specific aspects of cognitive abilities. For example, in a review of the research literature Halpern (1997) found that women appear, on average, superior to men on measures of fine motor skill, acquired knowledge, reading comprehension, decoding non-verbal expression, and generally have higher grades in school. Men, by contrast, appear, on average, superior to women on measures of fluid reasoning related to math and science, perceptual tasks that involve moving objects, and tasks that require transformations in working memory such as mental rotations of physical spaces. Halpern also notes that men are disproportionately represented on the low end of cognitive functioning including in intellectual disability, dyslexia, and attention deficit disorders (Halpern, 1997).

Other researchers have examined various explanatory hypotheses for why sex differences in intellectual ability occur. Some studies have provided mixed evidence for genetic factors while others point to evidence for social factors (Neisser, et al, 1996; Nisbett, et al., 2012). One interesting phenomenon that has received research scrutiny is the idea of **stereotype threat**. Stereotype threat is the idea that mental access to a particular stereotype can have real-world impact on a member of the stereotyped group. In one study (Spencer, Steele, & Quinn, 1999), for example, women who were informed that women tend to fare poorly on math exams just before taking a math test actually performed worse relative to a control group who did not hear the stereotype. Research on stereotype threat has

yielded mixed results and we are currently uncertain about exactly how and when this effect might occur. One possible antidote to stereotype threat, at least in the case of women, is to make a self-affirmation (such as listing positive personal qualities) before the threat occurs. In one study, for instance, Martens and her colleagues (2006) had women write about personal qualities that they valued before taking a math test. The affirmation largely erased the effect of stereotype by improving math scores for women relative to a control group but similar affirmations had little effect for men (Martens, Johns, Greenberg, & Schimel, 2006).

These types of controversies raise the question of if there might be a problem with intelligence measures. This is an important question to raise. It is important that we regularly evaluate the degree to which measures may be biased against certain groups of people. There is currently a very active and critically important discussion happening among scientists regarding bias in measures against certain groups of people.

Conclusion

Although you might not be able to spell “esquamulose” or “staphylococci” – indeed, you might not even know what they mean—you don’t need to count yourself out in the intelligence department. Now that we have examined intelligence in depth we can return to our intuitive view of those students who compete in the National Spelling Bee. Are they smart? Certainly, they seem to have high verbal intelligence. There is also the possibility that they benefit from either a genetic boost in intelligence, a supportive social environment, or both. Watching them spell difficult words there is also much we do not know about them. We cannot tell, for instance, how emotionally intelligent they are or how they might use bodily-kinesthetic intelligence. This highlights the fact that

intelligence is a complicated issue. Fortunately, psychologists continue to research this topic and their studies continue to yield new insights. Importantly, research is currently being conducted to both detect and ensure that systematic biases are addressed and rectified.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

G

Short for “general factor” and is often used to be synonymous with intelligence itself.

Intelligence

An individual's cognitive capability. This includes the ability to acquire, process, recall and apply information.

IQ

Short for “intelligence quotient.” This is a score, typically obtained from a widely used measure of intelligence that is meant to rank a person's intellectual ability against that of others.

Norm

Assessments are given to a representative sample of a population to determine the range of scores for that population. These “norms” are then used to place an individual who takes that assessment on a range of scores in which he or she is compared to the population at large.

Standardize

Assessments that are given in the exact same manner to all people . With regards to intelligence tests standardized scores are individual scores that are computed to be referenced against normative scores for a population (see “norm”).

Stereotype threat

The phenomenon in which people are concerned that they will conform to a stereotype or that their performance does conform to that stereotype, especially in instances in which the stereotype is brought to their conscious awareness.

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46. Intellectual Abilities, Interests, and Mastery

Original chapter by David Lubinski adapted by the Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen’s Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

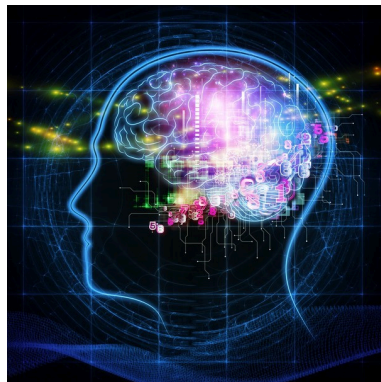
Psychologists interested in the study of human individuality have found that accomplishments in education, the world of work, and creativity are a joint function of talent, passion, and commitment — or how much effort and time one is willing to invest in personal development when the opportunity is provided. This module reviews models and measures that psychologists have designed to assess intellect, interests, and energy for personal development. The module begins with a model for organizing these three psychological domains, which is useful for understanding talent development. This model is not only helpful for understanding the many different ways that positive development may unfold among people, but it is also useful for conceptualizing personal development and ways of selecting opportunities in learning and work settings

that are more personally meaningful. Data supporting this model are reviewed.

Learning Objectives

- Compare and contrast satisfaction and satisfactoriness.
- Discuss why the model of talent development offered in this module places equal emphasis on assessing the person and assessing the environment.
- Articulate the relationship between ability and learning and performance.
- Understand the issue of an “ability threshold” beyond which more ability may or may not matter.
- List personal attributes other than interests and abilities that are important to individual accomplishment.

An amalgam of intelligence, interests, and mastery are appropriate topics for an essay on the cross-cutting themes running through these vast domains of psychological diversity. For effective performance and valued accomplishments, these three classes of determinants are needed for comprehensive treatments of psychological phenomena supporting learning, occupational performance, and for advancing knowledge through



Although Plato's view of human intelligence may be quite dated, modern-day analyses describe a similar model for understanding humans' intellectual application and development. [Image: A Health Blog, <https://goo.gl/O8FoHH>, CC BY-SA 2.0, <https://goo.gl/rxiUsF>]

innovative solutions. Historically, these personal attributes go back to at least Plato's triarchic view of the human psyche, described in *Phaedra*, wherein he depicts the *intellect* as a charioteer, and *affect* (interests) and *will* (to master) as horses that draw the chariot. Ever since that time, cognitive, affective, and conative factors have all been found in comprehensive models of human development, or "The Trilogy of Mind" (Hilgard, 1980). To predict the magnitude, nature, and sophistication of intellectual development toward learning, working, and creating, all three classes are indispensable and deficits on any one can markedly hobble the effectiveness of the others in meeting standards for typical as well as extraordinary performance. These three aspects of human individuality all operate in parallel confluences of behaviors, perceptions, and stimuli to engender stream of consciousness experiences as well as effective functioning. Hilgard (1980) was indeed justified to criticize formulations in cognitive psychology, which neglect affection and conation; technically, such truncated frameworks of human psychological phenomena are known as **under-determined or misspecified causal models** (Lubinski, 2000; Lubinski & Humphreys, 1997).

A Framework for Understanding Talent Development

Figure 1 is an adaptation of the Theory of Work Adjustment (TWA; Dawis & Lofquist, 1984; Lubinski & Benbow, 2000). It provides a useful organizational scheme for this treatment by outlining critical dimensions of human individuality for performance in learning and work settings (and in transitioning between such settings). Here, the dominant models of intellectual abilities and educational-occupational interests are assembled. Because this review will be restricted

to measures of individual differences that harbor real-world significance, these two models are linked to corresponding features of learning and work environments, ability requirements and incentive or reward structures, which set standards for meeting expectations (performance) and rewarding valued performance (compensation). Correspondence between abilities and ability requirements constitutes satisfactoriness ("competence"), whereas correspondence between an interests and reward structures constitutes **satisfaction** ("fulfillment"). To the extent that **satisfactoriness** and satisfaction co-occur, the individual is motivated to maintain contact with the environment and the environment is motivated to retain the individual; if one of these dimensions is dis-correspondent, the individual is motivated to leave the environment or the environment is motivated to dismiss.

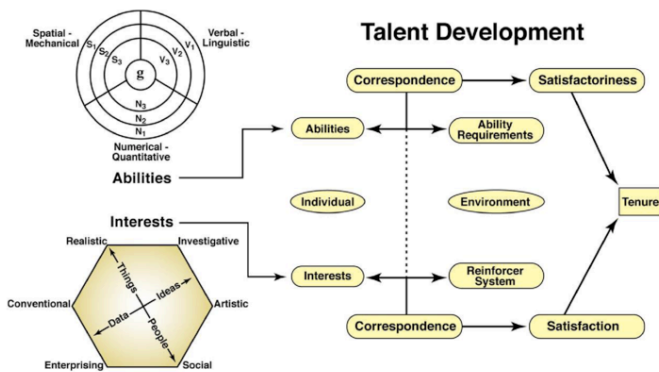


Figure 1. The above is an adaptation of the Theory of Work Adjustment (Dawis & Lofquist, 1984), following Lubinski and Benbow (2000) to highlight its general role in talent development over the life span. The radex scaling of cognitive abilities (upper left) and the RIASEC hexagon of interests (lower left) outline personal attributes relevant to learning and work. The letters within the cognitive ability arrangement denote different regions of concentration, whereas their accompanying numbers increase as a function of complexity. Contained within the RIASEC is a simplification of this hexagon. Following Prediger (1982), it amounts to a two-dimensional structure of independent dimensions: people/things and data/ideas, which underlie RIASEC. The dotted line running down the individual and environment sectors underscores the idea that equal emphasis is placed on assessing personal attributes (abilities and interests) and assessing the environment (abilities requirements and reward structure). Correspondence between abilities and ability requirements constitutes satisfactoriness whereas correspondence between interests and reinforce systems constitutes satisfaction. Jointly, these two dimensions predict tenure or a longstanding relationship between the individual and the environment.

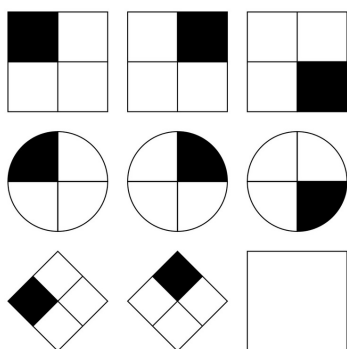
This model of talent development places equal emphasis on assessing the individual (abilities and interests) and the environment (response requirements and reward structures). Comprehensive reviews of outcomes within education (Lubinski, 1996; Lubinski & Benbow, 2000), counseling (Dawis, 1992; Gottfredson, 2003; Rounds & Tracey, 1990), and industrial/organizational psychology all emphasize this person/

environment tandem (**Dawis, 1991; Katzell, 1994; Lubinski & Dawis, 1992; Strong, 1943**): aligning competency/motivational proclivities to performance standards and reward structures for learning and work (**Bouchard, 1997; Scarr, 1996; Scarr & McCartney, 1983**). And indeed, educational, counseling, and industrial psychology can be contiguously sequenced by this framework. They all share a common feature: the scientific study of implementing interventions or opportunities, based on individual differences, for maximizing positive psychological growth across different stages of life span development (**Lubinski, 1996**). For making individual decisions about personal development, or institutional decisions about organizational development, it is frequently useful to go beyond a minimum requisite approach of “do you like it” (satisfaction) and “can you do it” (satisfactoriness), and instead consider what individuals like the most and can do the best (**Lubinski & Benbow, 2000, 2001**). This framework is useful for identifying “optimal promise” for personal as well as organizational development. For now, however, cognitive abilities and interests will be reviewed and, ultimately, linked to conative determinants that mobilize, and in part account for, individual differences in how capabilities and motives are expressed.

Cognitive Abilities

Over the past several decades—the past 20 years in particular—a remarkable consensus has emerged that cognitive abilities are organized hierarchically (**Carroll, 1993**). A general outline of this hierarchy is represented graphically by a radex (**Guttman, 1954**), depicted in the upper left region of Figure 1. This illustrates the reliable finding that cognitive ability assessments covary as a function of their content or complexity (**Corno, Cronbach et al., 2002; Lubinski & Dawis, 1992; Snow**

& Lohman, 1989). Cognitive ability tests can be scaled in this space based on how highly they covary with one another. The more that two tests share complexity and content, the more they covary and the closer they are to one another as points within the radex. Test *complexity* is scaled from the center of the radex (“g”) out, and, along lines emanating from the origin, complexity decreases but test content remains the same. Test *content* is scaled around the circular bands with equal distance from the center of the radex and, progressing around these bands, the relative density of test content changes from spatial/mechanical to verbal/linguistic to quantitative/numerical, but test complexity remains constant. Therefore, test content varies *within* each band (but complexity remains constant), whereas test complexity varies *between* bands (but on lines from the origin to the periphery, content remains constant). Because the extent to which tests covary is represented by how close together they are within this space (**Lubinski & Dawis, 1992; Snow & Lohman, 1989; Wai, Lubinski, & Benbow, 2009**), this model is helpful in organizing the many different kinds of specific ability tests.



As you can tell already, trying to document one's intelligence in problem-solving tests is very complicated. So although online "IQ tests" can be fun, rarely are they actually accurate. [Image: Life of Riley, <https://goo.gl/siweyC>, CC BY-SA 3.0, <https://goo.gl/eLCn2O>]

As Piaget astutely pointed out, "Intelligence is what you use when you don't know what to do," and this model affords an excellent overview of the content and sophistication of thought applied to familiar and novel problem-solving tasks. Mathematical, spatial, and verbal reasoning constitute the chief specific abilities with implications for different choices and performance after those choices in learning and work settings (Corno et al., 2002; Dawis,

1992; Gottfredson, 2003; Lubinski, 2004; Wai et al., 2009). The content of measures or tests of these specific abilities index individual differences in different modalities of thought: reasoning with numbers, words, and figures or shapes. Yet, despite this disparate content and focus, contrasting specific ability tests are all positively correlated, because they all index an underlying general property of intellectual thought.

This general (common) dimension, identified over 100 years ago (Spearman, 1904) and corroborated by a massive quantity of subsequent research (Carroll, 1993; Jensen, 1998), is *general mental ability*, the *general factor*, or simply *g* (Gottfredson, 1997). **General mental ability** represents the complexity/sophistication of a person's intellectual repertoire (Jensen, 1998; Lubinski & Dawis, 1992). The more complex a test is, regardless of its content, the better a measure of *g* it is. Further, because *g* underlies all cognitive reasoning processes, any test that assesses a specific ability is also, to some extent, a measure

of *g* (Lubinski, 2004). In school, work, and a variety of everyday life circumstances, assessments of this general dimension covary more broadly and deeper than any other measure of human individuality (Hunt, 2011; Jensen, 1998; Lubinski, 2000, 2004).

Measures of *g* manifest their life importance by going beyond educational settings (where they covary with educational achievement assessments in the .70–.80 range), by playing a role in shaping phenomena within Freud's two important life domains, *arbeiten* and *lieben*, working and loving (or, resource acquisition and mating). Measures of *g* covary .20–.60 with work performance as a function of job complexity, .30–.40 with income, and –.20 with criminal behavior, .40 with SES of origin, and .50–.70 with achieved SES; assortative mating correlations on *g* are around .50 (Jensen, 1998; Lubinski, 2004; Schmidt & Hunter, 1998). Furthermore, Malcolm Gladwell (2008) notwithstanding, there does *not* appear to be an ability threshold; that is, the idea that after a certain point more ability does not matter. More ability does matter.

Although other determinants are certainly needed (interests, persistence, opportunity), more ability does make a difference in learning, working, and creating, even among the top 1% of ability, or IQ equivalents ranging from approximately 137 to over 200 (see Figure 2). When appropriate assessment and criterion measures are utilized to capture the breadth of ability and accomplishment differences among the profoundly talented, individual differences within the top 1% of ability are shown to matter a great deal. In the past this has been difficult to demonstrate, because intellectual assessments and criterion measures lacked sufficient scope in gifted or intellectually talented populations, which resulted in no variation in assessments among the able and exceptionally able (ceiling effects). Without variation there cannot be co-variation, but modern methods have now corrected for this (Kell, Lubinski,

& Benbow, 2013a; Lubinski, 2009; Park, Lubinski, & Benbow, 2007, 2008). Yet, even when *g* is measured in its full scope, and validated with large samples and appropriate low-base-rate-criteria over protracted longitudinal intervals, there is much more to intellectual functioning than measures of *g* or general ability.

Accomplishments Across Individual Differences within the Top 1% of General Cognitive Ability: 25+ Years After Identified at Age 13

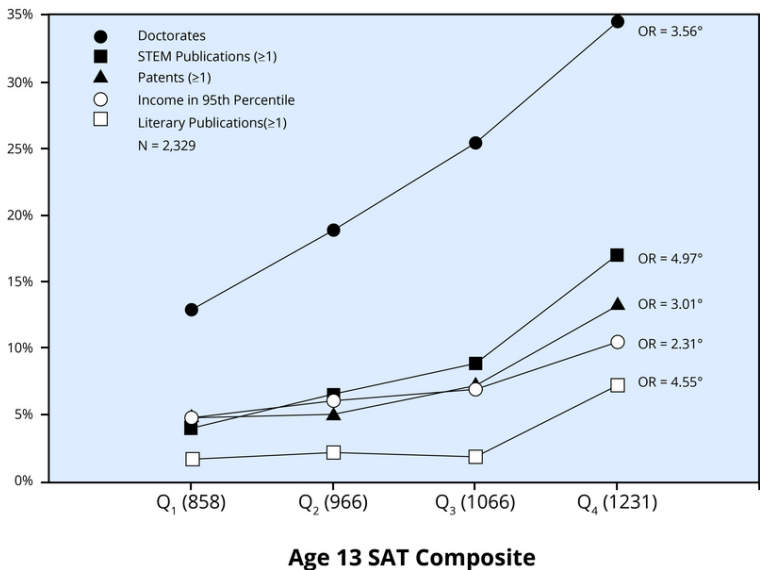


Figure 2. Frey and Detterman (2004) have shown that the SAT composite is an excellent measure of general intelligence for high ability samples; here, intellectually precocious youth were assessed on this composite at age 13 and separated into quartiles (Lubinski, 2009). The mean age 13 SAT composite scores for each quartile are displayed in parentheses along the x-axis. Odds ratios comparing the likelihood of each outcome in the top (Q4) and bottom (Q1) SAT quartiles are displayed at the end of every respective criterion line. An asterisk indicates that the 95% confidence interval for the odds ratio did not include 1.0, meaning that the likelihood of the outcome in Q4 was significantly greater than in Q1. These SAT assessments by age 13 were conducted before the re-centering of the SAT in the mid-1990s (i.e., during the 1970s and early 1980s); at that time, cutting scores for the top 1 in 200 were SAT-M ≥ 500, SAT-V ≥ 430; for the top 1 in 10,000, cutting scores were SAT-M ≥ 700, SAT-V ≥ 630 by age 13.

To reveal how general and **specific abilities** operate over the course of development, Figure 3 contains data from over 400,000 high schools students assessed between grades 9

through 12, and tracked for 11 years. Specifically, Figure 3 graphs the general and specific ability profiles of students earning terminal degrees in nine disciplines (**Wai et al., 2009**). Given that highly congruent findings were observed for all four cohorts (grades 9 through 12), the cohorts were combined. High general intelligence and an intellectual orientation dominated by high mathematical and spatial abilities, relative to verbal ability, were salient characteristics of individuals who pursued advanced education credentials in science, technology, engineering, and mathematics (STEM). These participants occupy a region in the intellectual space defined by the dimensions of ability level and ability pattern different from participants who earn undergraduate and graduate degrees in other domains.

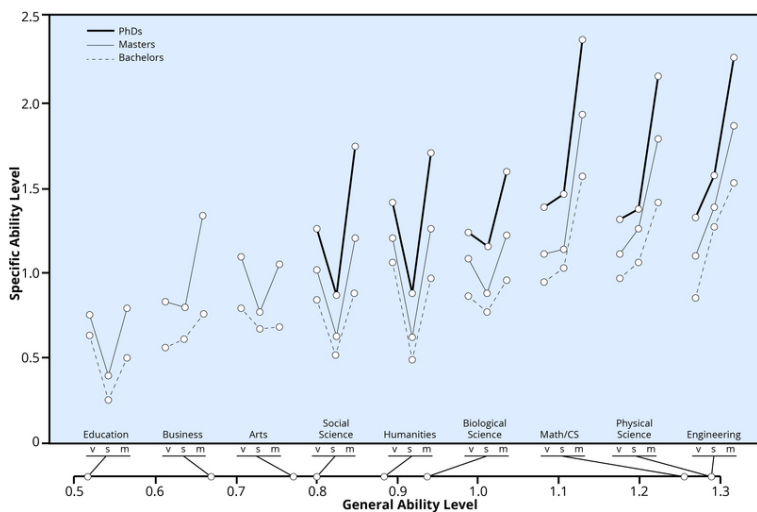


Figure 3. Average z scores of participants on verbal, spatial, and mathematical ability for terminal bachelor's degrees, terminal master's degrees, and doctoral degrees are plotted by field. The groups are plotted in rank order of their normative standing on g (verbal [V] + spatial [S] + mathematical [M]) along the x-axis, and the line with the arrows from each field pointing to it indicates on the continuous scale where they are in general mental ability in z-score units. This figure is standardized in relation to all participants with complete ability data at the time of initial testing. Respective N s for each group (men + women) were as follows for bachelor's, master's, and doctorates, respectively: engineering (1,143, 339, 71), physical science (633, 182, 202), math/computer science (877, 266, 57), biological science (740, 182, 79), humanities (3,226, 695, 82), social science (2,609, 484, 158), arts (615, 171 [master's only]), business (2,386, 191 [master's + doctorate]), and education (3,403, 1,505 [master's + doctorate]). For education and business, master's degrees and doctorates were combined because the doctorate samples for these groups were too small to obtain stability ($N = 30$). For the specific N for each degree by sex that composed the major groupings, see Appendix A in Wai et al. (2009).

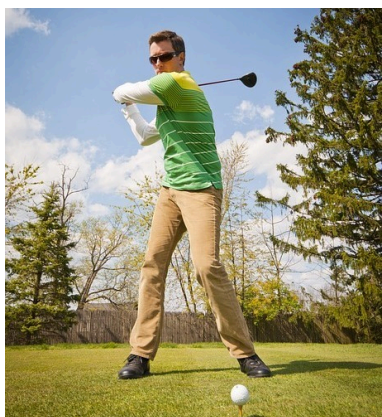
Two major differences distinguish the STEM from the non-STEM educational groups. First, students who ultimately secure educational credentials in STEM domains are more capable than those earning degrees in other areas, especially in nonverbal intellectual abilities. Within all educational domains,

more advanced degrees are associated with more general *and* specific abilities. Second, for all three STEM educational groupings (and the advanced degrees within these groupings), spatial ability > verbal ability—whereas for all others, ranging from education to biology, spatial ability < verbal ability (with business being an exception). Young adolescents who subsequently secured advanced educational credentials in STEM manifested a spatial–verbal ability pattern opposite that of those who ultimately earned educational credentials in other areas. These same patterns play out in occupational arenas in predictable ways (**Kell, Lubinski, Benbow, & Steiger, 2013b**). In the past decade, individual differences within the top 1% of ability have revealed that these patterns portend important outcomes for technical innovation and creativity, with respect to both ability level (**Lubinski, 2009; Park et al., 2008**) and pattern (**Kell et al. 2013a, Kell et al., 2013b; Park et al., 2007**). Level of general ability has predictive validity for the *magnitude* of accomplishment (how extraordinary they are), whereas ability pattern has predictive validity for the nature of accomplishments (the domains they occur in).

Interests

Just because people can do something well doesn't mean they like doing it. Psychological information on motivational differences (personal passions) is needed to understand attractions and aversions, different ways to create a meaningful life, and how differential development unfolds. Even people with the same intellectual equipment vary widely in their motivational proclivities. Paraphrasing Plato, different horses drive intellectual development down different life paths. The lower left region of Figure 1 provides the dominant model of vocational interests, one developed from decades of large-scale longitudinal and cross-cultural research. It shows a

hexagonal structure consisting of six general themes: Realistic (R) = working with gadgets and things, the outdoors, need for structure; Investigative (I) = scientific pursuits, especially mathematics and the physical science, an interest in theory; Artistic (A) = creative expression in art and writing, little need for structure; Social (S) = people interests, the helping professions, teaching, nursing, counseling; Enterprising (E) = likes leadership roles directed toward economic objectives; and Conventional (C) = liking of well-structured environments and clear chains of command, such as office practices.



It's pretty easy to think of things you're skilled at but don't enjoy doing. However, can you think of something you're not very skilled at but still enjoy doing? [Image: CC0 Public Domain, <https://goo.gl/m25gce>]

These six themes covary inversely with the distance between them, hence, the hexagonal structure circling around R-I-A-S-E-C. John Holland (1959, 1996)

justifiably receives most of the credit for this model (Day & Rounds, 1998), although Guilford et al. (1954) uncovered a similar framework based on military data and labeled them Mechanical, Scientific, Aesthetic Expression, Social Welfare, Business, and Clerical. Although each

theme contains multiple subcomponents, Holland's hexagon, like the radex of cognitive abilities, captures the general outlines of the educational/occupational interest domain, but there are molecular strands of intellectual and interest dimensions that add nuance to these general outlines (for abilities, see Carroll, 1993; for interests, see Dawis, 1991; Savickas & Spokane, 1999). There are also super-ordinal themes such as *people versus things* (Su, Rounds, & Armstrong, 2009), which

manifest arguably the largest sex-difference on a psychological dimension of human individuality.

At superordinate levels of *people versus things* or *data versus ideas* (**Prediger, 1982**), or at the RIASEC level of analysis, interest dimensions covary in different ways with mathematical, spatial, and verbal abilities (Ackerman, **1996**; Ackerman & Heggestad, **1997**; Schmidt, Lubinski, & Benbow, **1998**); and intense selection, when exclusively restricted to a specific ability, will eventuate in distinctive interest profiles across the three abilities with implications for differential development (Humphreys, Lubinski, & Yao, **1993**; Webb, Lubinski, & Benbow, **2007**). Although correlations between abilities and interests are “only” in the .20–.30 range, when selection is extreme, distinct profiles emerge and reflect different “types” (Lubinski & Benbow, **2000, 2006**). For basic science, this shows how ostensibly different kinds of intelligence at the extreme do not stem from different qualities, but rather from endpoint extremes within a multivariate space of systematic sources of individual differences, which “pull” with them constellations of nonintellectual personal attributes. For applied practice, skilled educational–vocational counselors routinely combine information on abilities and interests to distill learning and work environments that individuals are likely to thrive in competence and experience fulfillment (**Dawis, 1992**; Rounds & Tracy, **1990**). For further insights, a final class of important psychological determinants is needed, however.

Mastery

As all parents of more than one child know, there are huge individual differences in the extent to which individuals embrace opportunities for positive development. Seasoned faculty at top institutions for graduate training have observed the same phenomenon—among highly select graduate students, task commitment varies tremendously. Even among the intellectual elite, individual differences in



According to some researchers, it takes about 10,000 hours of practicing a skill to become an “expert” in it. Of course, one’s natural ability would vary this amount. However, either way, get to practicing! [Image: CC0 Public Domain, <https://goo.gl/m25gce>]

accomplishments stem from more than abilities, interests, and opportunity; conative determinants are critical catalysts. Galton (1869) called it “zeal,” Hull (1928) called it “industriousness,” and Webb (1915) called it “will.” Such labels as “grit” or “strivers” are sometimes used to define resources that people call upon to mobilize their abilities and interests over protracted intervals. Conative factors are distinct from abilities and preferences, having more to do with individual differences in energy or psychological tempo rather than the content of what people can do or how rapidly they learn. Indeed, characteristic across scientific studies of expertise and world-class accomplishment are attributes specifically indicative of indefatigable capacities for study and work. This is an underappreciated class of individual differences, although Ackerman (1996) has discussed *typical intellectual engagement* (TIE) and Dawis and Lofquist (1984) have discussed *pace* and *endurance*. This class of attributes simply has not received the attention it deserves.

Nevertheless, in the field of talent development and identification, the greatest consensus appears to be found on the topic of conation, rather than cognition or affect. Exceptional performers are deeply committed to what they do, and they devote a great deal of time to doing it. Regardless of the theorist, Howard Gardner, Dean Simonton, Arthur Jensen, Anders Erikson, and Harriet Zuckerman all agree that this is a uniform characteristic of world class performers at the top of their game. In the words of Dean Simonton and E. O. Wilson, respectively:

[M]aking it big [becoming a star] is a career. People who wish to do so must organize their whole lives around a single enterprise. They must be monomaniacs, even megalomaniacs, about their pursuits. They must start early, labor continuously, and never give up the cause. Success is not for the lazy, procrastinating, or mercurial. (Simonton, 1994, p. 181)

I have been presumptuous enough to counsel new Ph.D.'s in biology as follows: If you choose an academic career you will need forty hours a week to perform teaching and administrative duties, another twenty hours on top of that to conduct respectable research, and still another twenty hours to accomplish really important research. This formula is not boot-camp rhetoric. (Wilson, 1998, pp. 55–56)

Figure 4 contains data from two extraordinary populations of individuals (Lubinski, Benbow, Webb, & Bleske-Rechek, 2006). One group consists of a sample of profoundly gifted adolescents identified at age 12 as in the top 1 in 10,000 in mathematical or verbal reasoning ability; they were subsequently tracked for 20 years. Members of the second group were identified in their early twenties, as first- or second-year STEM graduate students enrolled in a top-15 U.S. university; they were subsequently tracked for 10 years. Now in

their mid-thirties, subjects were asked how much they would be *willing to work* in their “ideal job” and, second, how much they actually *do work*. The data are clear. There are huge individual differences associated with how much time people are willing to invest in their career development and work. The STEM graduate students are particularly interesting inasmuch as in their mid-twenties they were assessed on abilities, interests, and personality, and both sexes were found to be highly similar on these psychological dimensions (**Lubinski, Benbow, Shea, Eftekhari-Sanjani, & Halvorson, 2001**). But subsequently, over the life span, they markedly diverged in time allocation and life priorities (**Ceci & Williams, 2011; Ferriman, Lubinski, & Benbow, 2009**).

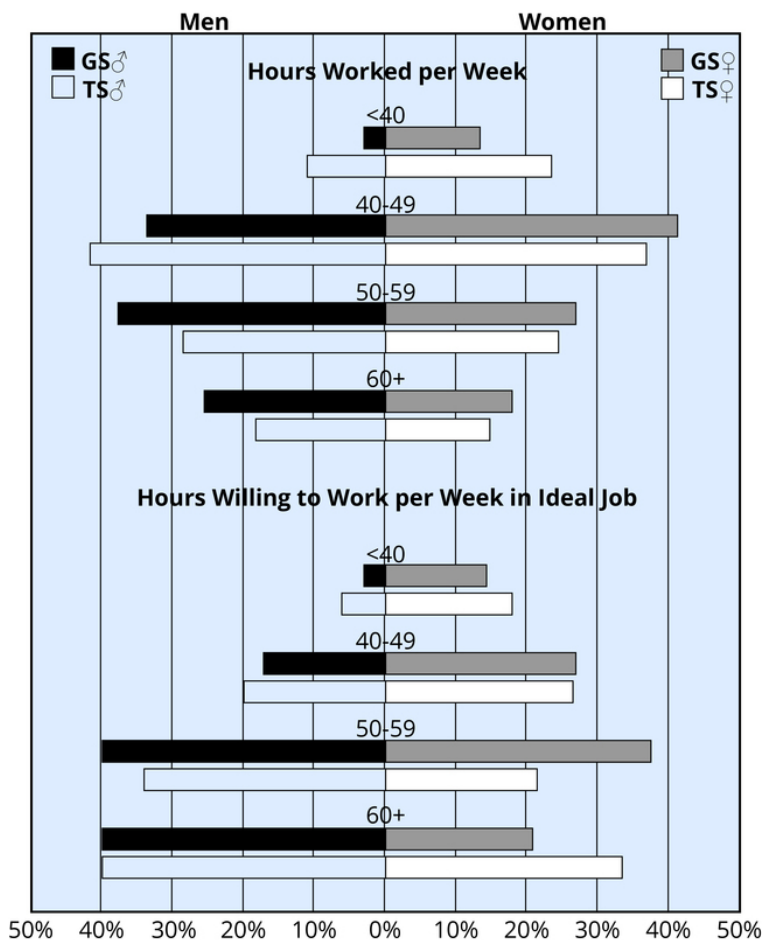


Figure 4: Hours worked per week (top) and hours willing to work per week in ideal job (bottom) for top STEM Graduate Students (GS) and Profoundly Gifted Talent Search (TS) participants now in their mid-thirties (from Lubinski et al., 2006).

These figures reveal huge *noncognitive* individual differences among individuals with exceptional intellectual talent. One only needs to imagine the ticking of a tenure clock and the differences likely to accrue over a 5-year interval between two

faculty working 45- versus 65-hour weeks (other things being equal). Making partner in a prestigious law firm is no different, nor is achieving genuine excellence in most intellectually demanding areas.

Conclusion

Since Spearman (1904) advanced the idea of general intelligence, a steady stream of systematic scientific knowledge has accrued in the psychological study of human individuality. We have learned that the intellect is organized hierarchically, that interests are multidimensional and only covary slightly with abilities, and that individual differences are huge in terms of investing in personal development. When these aspects of human psychological diversity are combined with commensurate attention devoted to opportunities for learning, work, and personal growth, a framework for understanding human development begins to take shape. Because frameworks may be found that emphasize only one set of these determinants, this essay closes with the recommendation—based on the empirical evidence—to stress all three.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You

can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

g or general mental ability

The general factor common to all cognitive ability measures, “a very general mental capacity that, among other things, involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly, and learn from experience. It is not merely book learning, a narrow academic skill, or test-taking smarts. Rather, it reflects a broader and deeper capability for comprehending our surroundings—‘catching on,’ ‘making sense of things,’ or ‘figuring out’ what to do” (Gottfredson, 1997, p. 13).

Satisfaction

Correspondence between an individual's needs or preferences and the rewards offered by the environment.

Satisfactoriness

Correspondence between an individual's abilities and the ability requirements of the environment.

Specific abilities

Cognitive abilities that contain an appreciable component of g or general ability, but also contain a large component of a more content-focused talent such as mathematical, spatial, or verbal ability; patterns of specific abilities channel development down different paths as a function of an individual's relative strengths and weaknesses.

Under-determined or misspecified causal models

Psychological frameworks that miss or neglect to include one or more of the critical determinants of the phenomenon under analysis.

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47. Judgment and Decision Making

Original chapter by Max H. Bazerman
adapted by the Queen's University
Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

Humans are not perfect decision makers. Not only are we not perfect, but we depart from perfection or rationality in systematic and predictable ways. The understanding of these systematic and predictable departures is core to the field of judgment and decision making. By understanding these limitations, we can also identify strategies for making better and more effective decisions.

Learning Objectives

- Understand the systematic biases that affect our judgment and decision making.
- Develop strategies for making better decisions.
- Experience some of the biases through sample decisions.

Introduction

Every day you have the opportunity to make countless decisions: should you eat dessert, cheat on a test, or attend a sports event with your friends. If you reflect on your own history of choices you will realize that they vary in quality; some are rational and some are not. This module provides an overview of decision making and includes discussion of many of the common biases involved in this process.

In his Nobel Prize-winning work, psychologist Herbert Simon (1957; March & Simon, 1958) argued that our decisions are bounded in their rationality. According to the **bounded rationality** framework, human beings try to make rational decisions (such as weighing the costs and benefits of a choice) but our cognitive limitations prevent us from being fully rational. Time and cost constraints limit the quantity and quality of the information that is available to us. Moreover, we only retain a relatively small amount of information in our usable memory. And limitations on intelligence and perceptions constrain the ability of even very bright decision makers to accurately make the best choice based on the information that is available.

About 15 years after the publication of Simon's seminal work, Tversky and Kahneman (1973, 1974; Kahneman & Tversky, 1979) produced their own Nobel Prize-winning research, which provided critical information about specific systematic and predictable **biases**, or mistakes, that influence judgment (Kahneman received the prize after Tversky's death). The work of Simon, Tversky, and Kahneman paved the way to our modern understanding of judgment and decision making. And their two Nobel prizes signaled the broad acceptance of the field of behavioral decision research as a mature area of intellectual study.

What Would a Rational Decision Look Like?



People often have to use incomplete information and intuition to make even the most important of decisions. A fully rational decision requires a careful, systematic process.
[Image: CC0 Public Domain, <https://goo.gl/m25gce>]

Imagine that during your senior year in college, you apply to a number of doctoral programs, law schools, or business schools (or another set of programs in whatever field most interests you). The good news is that you receive many acceptance letters. So, how should you decide where to go? Bazerman and Moore (2013) outline the following six steps that you should take to make a rational decision: (1) define the problem (i.e., selecting the right graduate program),

(2) identify the criteria necessary to judge the multiple options (location, prestige, faculty, etc.), (3) weight the criteria (rank them in terms of importance to you), (4) generate alternatives (the schools that admitted you), (5) rate each alternative on each criterion (rate each school on each criteria that you identified, and (6) compute the optimal decision. Acting rationally would require that you follow these six steps in a fully rational manner.

I strongly advise people to think through important decisions such as this in a manner similar to this process. Unfortunately, we often don't. Many of us rely on our intuitions far more than we should. And when we do try to think systematically, the way we enter data into such formal decision-making processes is often biased.

Fortunately, psychologists have learned a great deal about the biases that affect our thinking. This knowledge about the systematic and predictable mistakes that even the best and the brightest make can help you identify flaws in your thought processes and reach better decisions.

Biases in Our Decision Process

Simon's concept of bounded rationality taught us that judgment deviates from rationality, but it did not tell us *how* judgment is biased. Tversky and Kahneman's (1974) research helped to diagnose the specific systematic, directional biases that affect human judgment. These biases are created by the tendency to short-circuit a rational decision process by relying on a number of simplifying strategies, or rules of thumb, known as **heuristics**. Heuristics allow us to cope with the complex environment surrounding our decisions. Unfortunately, they also lead to systematic and predictable biases.

To highlight some of these biases please answer the following three quiz items:

Problem 1 (adapted from Alpert & Raiffa, 1969):

Listed below are 10 uncertain quantities. Do not look up any information on these items. For each, write down your best estimate of the quantity. Next, put a lower and upper bound around your estimate, such that you are 98 percent confident that your range surrounds the actual quantity. Respond to each of these items even if you admit to knowing very little about these quantities.

1. The first year the Nobel Peace Prize was awarded
2. The date the French celebrate “Bastille Day”
3. The distance from the Earth to the Moon
4. The height of the Leaning Tower of Pisa
5. Number of students attending Oxford University (as of 2014)
6. Number of people who have traveled to space (as of 2013)
7. 2012-2013 annual budget for the University of Pennsylvania
8. Average life expectancy in Bangladesh (as of 2012)
9. World record for pull-ups in a 24-hour period
10. Number of colleges and universities in the Boston metropolitan area

Problem 2 (adapted from Joyce & Biddle, 1981):

We know that executive fraud occurs and that it has been associated with many recent financial scandals. And, we know that many cases of management fraud go undetected even when annual audits are performed. Do you think that the incidence of significant executive-level management fraud is more than 10 in 1,000 firms (that is, 1 percent) audited by Big Four accounting firms?

- a. Yes, more than 10 in 1,000 Big Four clients have significant executive-level management fraud.
- b. No, fewer than 10 in 1,000 Big Four clients have significant executive-level management fraud.

What is your estimate of the number of Big Four clients per 1,000 that have significant executive-level management fraud? (Fill in the blank below with the appropriate number.)

_____ in 1,000 Big Four clients have significant executive-level management fraud.

Problem 3 (adapted from Tversky & Kahneman, 1981):

Imagine that the United States is preparing for the outbreak of an unusual avian disease that is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimates of the consequences of the programs are as follows.

1. Program A: If Program A is adopted, 200 people will be saved.
2. Program B: If Program B is adopted, there is a one-third probability that 600 people will be saved and a two-thirds probability that no people will be saved.

Which of the two programs would you favor?

Overconfidence

On the first problem, if you set your ranges so that you were justifiably 98 percent confident, you should expect that approximately 9.8, or nine to 10, of your ranges would include the actual value. So, let's look at the correct answers:

1. 1901
2. 14th of July
3. 384,403 km (238,857 mi)
4. 56.67 m (183 ft)
5. 22,384 (as of 2014)
6. 536 people (as of 2013)
7. \$6.007 billion
8. 70.3 years (as of 2012)
9. 4,321
10. 52



Overconfidence is a natural part of most people's decision-making process and this can get us into trouble. Is it possible to overcome our faulty thinking? Perhaps. See the "Fixing Our Decisions" section below. [Image: Barn Images, <https://goo.gl/IYzbDV>, CC BY 2.0, <https://goo.gl/BRvSA7>]

Count the number of your 98% ranges that actually surrounded the true quantities. If you surrounded nine to 10, you were appropriately confident in your judgments. But most readers surround

only between three (30%) and seven (70%) of the correct answers, despite claiming 98% confidence that each range would surround the true value. As this problem shows, humans tend to be **overconfident** in their judgments.

Anchoring

Regarding the second problem, people vary a great deal in their final assessment of the level of executive-level management fraud, but most think that 10 out of 1,000 is too low. When I run this exercise in class, half of the students respond to the question that I asked you to answer. The other half receive a similar problem, but instead are asked whether the correct answer is higher or lower than 200 rather than 10. Most people think that 200 is high. But, again, most people claim that this "**anchor**" does not affect their final estimate.

Yet, on average, people who are presented with the question that focuses on the number 10 (out of 1,000) give answers that are about one-half the size of the estimates of those facing questions that use an anchor of 200. When we are making decisions, any initial anchor that we face is likely to influence our judgments, even if the anchor is arbitrary. That is, we insufficiently adjust our judgments away from the anchor.

Framing

Turning to Problem 3, most people choose Program A, which saves 200 lives for sure, over Program B. But, again, if I was in front of a classroom, only half of my students would receive this problem. The other half would have received the same set-up, but with the following two options:

1. Program C: If Program C is adopted, 400 people will die.
2. Program D: If Program D is adopted, there is a one-third probability that no one will die and a two-thirds probability that 600 people will die.

Which of the two programs would you favor?

Careful review of the two versions of this problem clarifies that they are objectively the same. Saving 200 people (Program A) means losing 400 people (Program C), and Programs B and D are also objectively identical. Yet, in one of the most famous problems in judgment and decision making, most individuals choose Program A in the first set and Program D in the second set (**Tversky & Kahneman, 1981**). People respond very differently to saving versus losing lives—even when the difference is based just on the “**framing**” of the choices.

The problem that I asked you to respond to was framed in terms of saving lives, and the implied reference point was the worst outcome of 600 deaths. Most of us, when we make

decisions that concern gains, are risk averse; as a consequence, we lock in the possibility of saving 200 lives for sure. In the alternative version, the problem is framed in terms of losses. Now the implicit reference point is the best outcome of no deaths due to the avian disease. And in this case, most people are risk seeking when making decisions regarding losses.

These are just three of the many biases that affect even the smartest among us. Other research shows that we are biased in favor of information that is easy for our minds to retrieve, are insensitive to the importance of base rates and sample sizes when we are making inferences, assume that random events will always look random, search for information that confirms our expectations even when disconfirming information would be more informative, claim a priori knowledge that didn't exist due to the hindsight bias, and are subject to a host of other effects that continue to be developed in the literature (**Bazerman & Moore, 2013**).

Contemporary Developments



*The concept of bounded willpower may explain why many of us are better shoppers than savers.
[Image: CCO Public Domain,
<https://goo.gl/m25gce>]*

Bounded rationality served as the integrating concept of the field of behavioral decision research for 40 years. Then, in 2000, Thaler (2000) suggested that decision making is bounded in two ways not precisely captured by the concept of bounded rationality. First, he argued that our **willpower is bounded** and that, as a consequence, we give greater weight to present concerns than to future

concerns. Our immediate motivations are often inconsistent with our long-term interests in a variety of ways, such as the common failure to save adequately for retirement or the difficulty many people have staying on a diet. Second, Thaler suggested that our **self-interest is bounded** such that we care about the outcomes of others. Sometimes we positively value the outcomes of others—giving them more of a commodity than is necessary out of a desire to be fair, for example. And, in unfortunate contexts, we sometimes are willing to forgo our own benefits out of a desire to harm others.

My colleagues and I have recently added two other important bounds to the list. Chugh, Banaji, and Bazerman (2005) and Banaji and Bhaskar (2000) introduced the concept of **bounded ethicality**, which refers to the notion that our ethics are limited in ways we are not even aware of ourselves. Second, Chugh and Bazerman (2007) developed the concept of **bounded awareness** to refer to the broad array of focusing failures that affect our judgment, specifically the many ways in

which we fail to notice obvious and important information that is available to us.

A final development is the application of judgment and decision-making research to the areas of behavioral economics, behavioral finance, and behavioral marketing, among others. In each case, these fields have been transformed by applying and extending research from the judgment and decision-making literature.

Fixing Our Decisions

Ample evidence documents that even smart people are routinely impaired by biases. Early research demonstrated, unfortunately, that awareness of these problems does little to reduce bias (**Fischhoff, 1982**). The good news is that more recent research documents interventions that do help us overcome our faulty thinking (**Bazerman & Moore, 2013**).

One critical path to fixing our biases is provided in Stanovich and West's (2000) distinction between **System 1** and **System 2** decision making. System 1 processing is our intuitive system, which is typically fast, automatic, effortless, implicit, and emotional. System 2 refers to decision making that is slower, conscious, effortful, explicit, and logical. The six logical steps of decision making outlined earlier describe a System 2 process.

Clearly, a complete System 2 process is not required for every decision we make. In most situations, our System 1 thinking is quite sufficient; it would be impractical, for example, to logically reason through every choice we make while shopping for groceries. But, preferably, System 2 logic should influence our most important decisions. Nonetheless, we use our System 1 processes for most decisions in life, relying on it even when making important decisions.

The key to reducing the effects of bias and improving our decisions is to transition from trusting our intuitive System

1 thinking toward engaging more in deliberative System 2 thought. Unfortunately, the busier and more rushed people are, the more they have on their minds, and the more likely they are to rely on System 1 thinking (**Chugh, 2004**). The frantic pace of professional life suggests that executives often rely on System 1 thinking (**Chugh, 2004**).

Fortunately, it is possible to identify conditions where we rely on intuition at our peril and substitute more deliberative thought. One fascinating example of this substitution comes from journalist Michael Lewis' (**2003**) account of how Billy Beane, the general manager of the Oakland Athletics, improved the outcomes of the failing baseball team after recognizing that the intuition of baseball executives was limited and systematically biased and that their intuitions had been incorporated into important decisions in ways that created enormous mistakes. Lewis (**2003**) documents that baseball professionals tend to overgeneralize from their personal experiences, be overly influenced by players' very recent performances, and overweigh what they see with their own eyes, despite the fact that players' multiyear records provide far better data. By substituting valid predictors of future performance (System 2 thinking), the Athletics were able to outperform expectations given their very limited payroll.

Another important direction for improving decisions comes from Thaler and Sunstein's (2008) book *Nudge: Improving Decisions about Health, Wealth, and Happiness*. Rather than setting out to debias human judgment, Thaler and Sunstein outline a strategy for how “decision architects” can change environments in ways that account for human bias and trigger better decisions as a result. For example, Beshears, Choi,



Nudges can be used to help people make better decisions about saving for retirement.

[Image: Tax Credits, <https://goo.gl/YLuyth>, CC BY 2.0, <https://goo.gl/BRvSA7>]

Laibson, and Madrian (2008) have shown that simple changes to defaults can dramatically improve people's decisions. They tackle the failure of many people to save for retirement and show that a simple change can significantly influence enrollment in 401(k) programs. In most companies, when you start your job, you need to proactively sign up to join the company's retirement savings plan. Many people take years before getting around to doing so. When, instead, companies automatically enroll their employees in 401(k) programs and give them the opportunity to “opt out,” the net enrollment rate rises significantly. By changing defaults, we can counteract the human tendency to live with the status quo.

Similarly, Johnson and Goldstein's (2003) cross-European organ donation study reveals that countries that have opt-in organ donation policies, where the default is not to harvest people's organs without their prior consent, sacrifice thousands of lives in comparison to opt-out policies, where the default is to harvest organs. The United States and too many other countries require that citizens opt in to organ donation

through a proactive effort; as a consequence, consent rates range between 4.25%–44% across these countries. In contrast, changing the decision architecture to an opt-out policy improves consent rates to 85.9% to 99.98%. Designing the donation system with knowledge of the power of defaults can dramatically change donation rates without changing the options available to citizens. In contrast, a more intuitive strategy, such as the one in place in the United States, inspires defaults that result in many unnecessary deaths.

Judgment and Decision Making at Queen's University

Dr. Anita Tusche is a psychological scientist at Queen's who studies human decision making. In this video, Dr. Tusche discusses how although rationality might be desirable, it is not always present when humans make judgments or engage in decision making. Dr. Tusche further discusses the role of psychological science in understanding what can guide our judgments and decision making: by understanding flaws in our processes, we may be able to promote better decision making strategies.



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Concluding Thoughts

Our days are filled with decisions ranging from the small (what should I wear today?) to the important (should we get married?). Many have real world consequences on our health, finances and relationships. Simon, Kahneman, and Tversky created a field that highlights the surprising and predictable deficiencies of the human mind when making decisions. As we understand more about our own biases and thinking shortcomings we can begin to take them into account or to avoid them. Only now have we reached the frontier of using this knowledge to help people make better decisions.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Anchoring

The bias to be affected by an initial anchor, even if the anchor is arbitrary, and to insufficiently adjust our judgments away from that anchor.

Biases

The systematic and predictable mistakes that influence

the judgment of even very talented human beings.

Bounded awareness

The systematic ways in which we fail to notice obvious and important information that is available to us.

Bounded ethicality

The systematic ways in which our ethics are limited in ways we are not even aware of ourselves.

Bounded rationality

Model of human behavior that suggests that humans try to make rational decisions but are bounded due to cognitive limitations.

Bounded self-interest

The systematic and predictable ways in which we care about the outcomes of others.

Bounded willpower

The tendency to place greater weight on present concerns rather than future concerns.

Framing

The bias to be systematically affected by the way in which information is presented, while holding the objective information constant.

Heuristics

cognitive (or thinking) strategies that simplify decision making by using mental short-cuts

Overconfident

The bias to have greater confidence in your judgment than is warranted based on a rational assessment.

System 1

Our intuitive decision-making system, which is typically

fast, automatic, effortless, implicit, and emotional.

System 2

Our more deliberative decision-making system, which is slower, conscious, effortful, explicit, and logical.

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PSYC 100 XVII

MOTIVATION AND EMOTION

48. Drive States

Original chapter by Sudeep Bhatia and George Loewenstein adapted by the Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

Our thoughts and behaviors are strongly influenced by affective experiences known as drive states. These drive states motivate us to fulfill goals that are beneficial to our survival and reproduction. This module provides an overview of key drive states, including information about their neurobiology and their psychological effects.

Learning Objectives

- Identify the key properties of drive states
- Describe biological goals accomplished by drive states
- Give examples of drive states
- Outline the neurobiological basis of drive states such as hunger and arousal
- Discuss the main moderators and determinants of drive states such as hunger and arousal

Introduction

What is the longest you've ever gone without eating? A couple of hours? An entire day? How did it feel? Humans rely critically on food for nutrition and energy, and the absence of food can create drastic changes, not only in physical appearance, but in thoughts and behaviors. If you've ever fasted for a day, you probably noticed how hunger can take over your mind, directing your attention to foods you could be eating (a cheesy slice of pizza, or perhaps some sweet, cold ice cream), and motivating you to obtain and consume these foods. And once you have eaten and your hunger has been satisfied, your thoughts and behaviors return to normal.



Hunger is among our most basic motivators. [Image: Jeremy Brooks, <https://goo.gl/XrFG2W>, CC BY-NC 2.0, <https://goo.gl/VnKIK8>]

Hunger is a **drive state**, an affective experience (something you feel, like the sensation of being tired or hungry) that motivates organisms to fulfill goals that are generally beneficial to their survival and reproduction. Like other drive states, such as thirst or sexual arousal, hunger has a profound impact on the functioning of the mind. It affects psychological processes, such as

perception, attention, emotion, and motivation, and influences the behaviors that these processes generate.

Key Properties of Drive States

Drive states differ from other affective or emotional states in terms of the biological functions they accomplish. Whereas all affective states possess valence (i.e., they are positive or negative) and serve to motivate approach or avoidance behaviors (Zajonc, 1998), drive states are unique in that they generate behaviors that result in specific benefits for the body. For example, hunger directs individuals to eat foods that increase blood sugar levels in the body, while thirst causes individuals to drink fluids that increase water levels in the body.

Different drive states have different triggers. Most drive states respond to both internal and external cues, but the combinations of internal and external cues, and the specific types of cues, differ between drives. Hunger, for example, depends on internal, visceral signals as well as sensory signals, such as the sight or smell of tasty food. Different drive states also result in different cognitive and emotional states, and are associated with different behaviors. Yet despite these differences, there are a number of properties common to all drive states.

Homeostasis

Humans, like all organisms, need to maintain a stable state in their various physiological systems. For example, the excessive loss of body water results in dehydration, a dangerous and potentially fatal state. However, too much water can be damaging as well. Thus, a moderate and stable level of body fluid is ideal. The tendency of an organism to maintain this stability across all the different physiological systems in the body is called **homeostasis**.

Homeostasis is maintained via two key factors. First, the state

of the system being regulated must be monitored and compared to an ideal level, or a **set point**. Second, there need to be mechanisms for moving the system back to this set point—that is, to restore homeostasis when deviations from it are detected. To better understand this, think of the thermostat in your own home. It detects when the current temperature in the house is different than the temperature you have it set at (i.e., the set point). Once the thermostat recognizes the difference, the heating or air conditioning turns on to bring the overall temperature back to the designated level.

Many homeostatic mechanisms, such as blood circulation and immune responses, are automatic and nonconscious.

Others, however, involve deliberate action. Most drive states motivate action to restore homeostasis using both “punishments” and “rewards.” Imagine that these homeostatic mechanisms are like molecular parents. When you behave poorly by departing from the set point (such as not eating or being



The body needs homeostasis and motivates us – through both pleasure and pain – to stay in balance. [Image: ashleigh290, <https://goo.gl/yXQtEC>, CC-BY 2.0, <https://goo.gl/BRvSA7>]

somewhere too cold), they raise their voice at you. You experience this as the bad feelings, or “punishments,” of hunger, thirst, or feeling too cold or too hot. However, when you behave well (such as eating nutritious foods when hungry), these homeostatic parents reward you with the pleasure that comes from any activity that moves the system back toward the set point. For example, when body temperature declines below the set point, any activity that helps to restore homeostasis (such as putting one’s hand in warm water) feels

pleasurable; and likewise, when body temperature rises above the set point, anything that cools it feels pleasurable.

The Narrowing of Attention

As drive states intensify, they direct attention toward elements, activities, and forms of consumption that satisfy the biological needs associated with the drive. Hunger, for example, draws attention toward food. Outcomes and objects that are not related to satisfying hunger lose their value (**Easterbrook, 1959**). For instance, has anyone ever invited you to do a fun activity while you were hungry? Likely your response was something like: “I’m not doing anything until I eat first.” Indeed, at a sufficient level of intensity, individuals will sacrifice almost any quantity of goods that do not address the needs signaled by the drive state. For example, cocaine addicts, according to Gawin (**1991**), “report that virtually all thoughts are focused on cocaine during binges; nourishment, sleep, money, loved ones, responsibility, and survival lose all significance.”

Drive states also produce a second form of attention-narrowing: a collapsing of time-perspective toward the present. That is, they make us impatient. While this form of attention-narrowing is particularly pronounced for the outcomes and behaviors directly related to the biological function being served by the drive state at issue (e.g., “I need food *now*”), it applies to general concerns for the future as well. Ariely and Loewenstein (**2006**), for example, investigated the impact of sexual arousal on the thoughts and behaviors of a sample of male undergraduates. These undergraduates were lent laptop computers that they took to their private residences, where they answered a series of questions, both in normal states and in states of high sexual arousal. Ariely and Loewenstein found that being sexually aroused made people extremely impatient for both sexual outcomes and for

outcomes in other domains, such as those involving money. In another study Giordano et al. (**2002**) found that heroin addicts were more impatient with respect to heroin when they were craving it than when they were not. More surprisingly, they were also more impatient toward money (they valued delayed money less) when they were actively craving heroin.

Yet a third form of attention-narrowing involves thoughts and outcomes related to the self versus others. Intense drive states tend to narrow one's focus inwardly and to undermine altruism—or the desire to do good for others. People who are hungry, in pain, or craving drugs tend to be selfish. Indeed, popular interrogation methods involve depriving individuals of sleep, food, or water, so as to trigger intense drive states leading the subject of the interrogation to divulge information that may betray comrades, friends, and family (**Biderman, 1960**).

Current Controversy

In 2005, the American Psychological Association (APA) issued a report concluding that psychologists could ethically play a role in the interrogation of people captured in Afghanistan and elsewhere. In 2014, following critical media publicity documenting the APA's involvement in torture, the APA commissioned a law firm to independently investigate APA involvement in interrogation. The firm's report was damaging to the APA because it suggested that APA leaders colluded with the Department of Defense, CIA, and other government officials not only to aid in interrogation itself, but to provide justification for government guidelines that defined torture (which is banned by international treaties signed by the U.S.) in a narrow fashion that excluded, for example so-called "stress positions" and sleep deprivation.

Critical Questions

1. Do you think that manipulating drive states, such as the need for sleep, constitutes torture?
2. How do you think research on drive states should inform the definition of "torture" and our definition of ethical interrogation techniques?

See the full Hoffman Report here - <http://www.apa.org/independent-review/APA-FINAL-Report-7.2.15.pdf>

For more coverage - <http://www.nytimes.com/2015/07/11/us/psychologists-shielded-us-torture-program-report-finds.html>

Two Illustrative Drive States

Thus far we have considered drive states abstractly. We have discussed the ways in which they relate to other affective and motivational mechanisms, as well as their main biological purpose and general effects on thought and behavior. Yet, despite serving the same broader goals, different drive states are often remarkably different in terms of their specific properties. To understand some of these specific properties, we will explore two different drive states that play very important

roles in determining behavior, and in ensuring human survival: hunger and sexual arousal.

Hunger



External cues, like the sight and smell of food, can ignite feelings of hunger. [Image: Marco Verch, <https://goo.gl/c4TC5A>, CC BY 2.0, <https://goo.gl/BRvSA7>]

Hunger is a classic example of a drive state, one that results in thoughts and behaviors related to the consumption of food. Hunger is generally triggered by low glucose levels in the blood (**Rolls, 2000**), and behaviors resulting from hunger aim to restore homeostasis regarding those glucose levels. Various other internal and external cues can also cause hunger. For example, when fats are broken down in

the body for energy, this initiates a chemical cue that the body should search for food (Greenberg, Smith, & Gibbs, **1990**). External cues include the time of day, estimated time until the next feeding (hunger increases immediately prior to food consumption), and the sight, smell, taste, and even touch of food and food-related stimuli. Note that while hunger is a generic feeling, it has nuances that can provoke the eating of specific foods that correct for nutritional imbalances we may not even be conscious of. For example, a couple who was lost adrift at sea found they inexplicably began to crave the eyes of fish. Only later, after they had been rescued, did they learn that fish eyes are rich in vitamin C—a very important nutrient that they had been depleted of while lost in the ocean (**Walker, 2014**).

The **hypothalamus** (located in the lower, central part of the brain) plays a very important role in eating behavior. It is responsible for synthesizing and secreting various hormones. The lateral hypothalamus (LH) is concerned largely with hunger and, in fact, lesions (i.e., damage) of the LH can eliminate the desire for eating entirely—to the point that animals starve themselves to death unless kept alive by force feeding (**Anand & Brobeck, 1951**). Additionally, artificially stimulating the LH, using electrical currents, can generate eating behavior if food is available (**Andersson, 1951**).

Activation of the LH can not only increase the desirability of food but can also reduce the desirability of nonfood-related items. For example, Brendl, Markman, and Messner (**2003**) found that participants who were given a handful of popcorn to trigger hunger not only had higher ratings of food products, but also had lower ratings of nonfood products—compared with participants whose appetites were not similarly primed. That is, because eating had become more important, other non-food products lost some of their value.

Hunger is only part of the story of when and why we eat. A related process, **satiati**on, refers to the decline of hunger and the eventual termination of eating behavior. Whereas the feeling of hunger gets you to start eating, the feeling of satiati

on gets you to stop. Perhaps surprisingly, hunger and satiati

on are two distinct processes, controlled by different circuits in the brain and triggered by different cues. Distinct from the LH, which plays an important role in hunger, the ventromedial hypothalamus (VMH) plays an important role in satiety. Though lesions of the VMH can cause an animal to overeat to the point of obesity, the relationship between the LH and the VMB is quite complicated. Rats with VMH lesions can also be quite finicky about their food (**Teitelbaum, 1955**).

Other brain areas, besides the LH and VMH, also play important roles in eating behavior. The sensory cortices (visual, olfactory, and taste), for example, are important in identifying

food items. These areas provide informational value, however, not hedonic evaluations. That is, these areas help tell a person what is good or safe to eat, but they don't provide the pleasure (or hedonic) sensations that *actually* eating the food produces. While many sensory functions are roughly stable across different psychological states, other functions, such as the detection of food-related stimuli, are enhanced when the organism is in a hungry drive state.

After identifying a food item, the brain also needs to determine its **reward value**, which affects the organism's motivation to consume the food. The reward value ascribed to a particular item is, not surprisingly, sensitive to the level of hunger experienced by the organism. The hungrier you are, the greater the reward value of the food. Neurons in the areas where reward values are processed, such as the orbitofrontal cortex, fire more rapidly at the sight or taste of food when the organism is hungry relative to if it is satiated.

Sexual Arousal

A second drive state, especially critical to reproduction, is sexual arousal. Sexual arousal results in thoughts and behaviors related to sexual activity. As with hunger, it is generated by a large range of internal and external mechanisms that are triggered either after the extended absence of sexual activity or by the immediate presence and possibility of sexual activity (or by cues commonly associated with such



Unlike other drive states the mechanisms that trigger sexual arousal are not the same for men and women. [Image: Matthew Romack, <https://goo.gl/IUbbk0>, CC BY 2.0, <https://goo.gl/BRvSA7>]

possibilities). Unlike hunger, however, these mechanisms can differ substantially between males and females, indicating important evolutionary differences in the biological functions that sexual arousal serves for different sexes.

Sexual arousal and pleasure in males, for example, is strongly related to the **preoptic area**, a region in the anterior hypothalamus (or the front of the hypothalamus). If the preoptic area is damaged, male sexual behavior is severely impaired. For example, rats that have had prior sexual experiences will still seek out sexual partners after their preoptic area is lesioned. However, once having secured a sexual partner, rats with lesioned preoptic areas will show no further inclination to actually initiate sex.

For females, though, the preoptic area fulfills different roles, such as functions involved with eating behaviors. Instead, there is a different region of the brain, the ventromedial hypothalamus (the lower, central part) that plays a similar role

for females as the preoptic area does for males. Neurons in the ventromedial hypothalamus determine the excretion of estradiol, an estrogen hormone that regulates sexual receptivity (or the willingness to accept a sexual partner). In many mammals, these neurons send impulses to the periaqueductal gray (a region in the midbrain) which is responsible for defensive behaviors, such as freezing immobility, running, increases in blood pressure, and other motor responses. Typically, these defensive responses might keep the female rat from interacting with the male one. However, during sexual arousal, these defensive responses are weakened and lordosis behavior, a physical sexual posture that serves as an invitation to mate, is initiated (**Kow and Pfaff, 1998**). Thus, while the preoptic area encourages males to engage in sexual activity, the ventromedial hypothalamus fulfills that role for females.

Other differences between males and females involve overlapping functions of neural modules. These neural modules often provide clues about the biological roles played by sexual arousal and sexual activity in males and females. Areas of the brain that are important for male sexuality overlap to a great extent with areas that are also associated with aggression. In contrast, areas important for female sexuality overlap extensively with those that are also connected to nurturance (**Panksepp, 2004**).

One region of the brain that seems to play an important role in sexual pleasure for both males and females is the septal nucleus, an area that receives reciprocal connections from many other brain regions, including the hypothalamus and the amygdala (a region of the brain primarily involved with emotions). This region shows considerable activity, in terms of rhythmic spiking, during sexual orgasm. It is also one of the brain regions that rats will most reliably voluntarily self-stimulate (**Olds & Milner, 1954**). In humans, placing a small amount of acetylcholine into this region, or stimulating it

electrically, has been reported to produce a feeling of imminent orgasm (**Heath, 1964**).

Conclusion

Drive states are evolved motivational mechanisms designed to ensure that organisms take self-beneficial actions. In this module, we have reviewed key properties of drive states, such as homeostasis and the narrowing of attention. We have also discussed, in some detail, two important drive states—hunger and sexual arousal—and explored their underlying neurobiology and the ways in which various environmental and biological factors affect their properties.

There are many drive states besides hunger and sexual arousal that affect humans on a daily basis. Fear, thirst, exhaustion, exploratory and maternal drives, and drug cravings are all drive states that have been studied by researchers (see e.g., **Buck, 1999; Van Boven & Loewenstein, 2003**). Although these drive states share some of the properties discussed in this module, each also has unique features that allow it to effectively fulfill its evolutionary function.

One key difference between drive states is the extent to which they are triggered by internal as opposed to external stimuli. Thirst, for example, is induced both by decreased fluid levels and an increased concentration of salt in the body. Fear, on the other hand, is induced by perceived threats in the external environment. Drug cravings are triggered both by internal homeostatic mechanisms and by external visual, olfactory, and contextual cues. Other drive states, such as those pertaining to maternity, are triggered by specific events in the organism's life. Differences such as these make the study of drive states a scientifically interesting and important endeavor. Drive states are rich in their diversity, and many questions

involving their neurocognitive underpinnings, environmental determinants, and behavioral effects, have yet to be answered.

One final thing to consider, not discussed in this module, relates to the real-world consequences of drive states. Hunger, sexual arousal, and other drive states are all psychological mechanisms that have evolved gradually over millions of years. We share these drive states not only with our human ancestors but with other animals, such as monkeys, dogs, and rats. It is not surprising then that these drive states, at times, lead us to behave in ways that are ill-suited to our modern lives. Consider, for example, the obesity epidemic that is affecting countries around the world. Like other diseases of affluence, obesity is a product of drive states that are too easily fulfilled: homeostatic mechanisms that once worked well when food was scarce now backfire when meals rich in fat and sugar are readily available. Unrestricted sexual arousal can have similarly perverse effects on our well-being. Countless politicians have sacrificed their entire life's work (not to mention their marriages) by indulging adulterous sexual impulses toward colleagues, staffers, prostitutes, and others over whom they have social or financial power. It not an overstatement to say that many problems of the 21st century, from school massacres to obesity to drug addiction, are influenced by the mismatch between our drive states and our uniquely modern ability to fulfill them at a moment's notice.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage

you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Drive state

Affective experiences that motivate organisms to fulfill goals that are generally beneficial to their survival and reproduction.

Homeostasis

The tendency of an organism to maintain a stable state across all the different physiological systems in the body.

Homeostatic set point

An ideal level that the system being regulated must be monitored and compared to.

Hypothalamus

A portion of the brain involved in a variety of functions, including the secretion of various hormones and the regulation of hunger and sexual arousal.

Lordosis

A physical sexual posture in females that serves as an invitation to mate.

Preoptic area

A region in the anterior hypothalamus involved in generating and regulating male sexual behavior.

Reward value

A neuropsychological measure of an outcome's affective importance to an organism.

Satiation

The state of being full to satisfaction and no longer desiring to take on more.

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49. Emotion Experience and Well-Being

Original chapter by Brett Ford and Iris B. Mauss adapted by the Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen’s Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

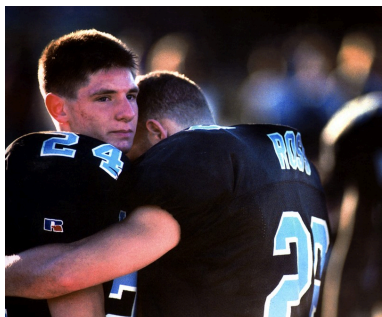
Emotions don't just feel good or bad, they also contribute crucially to people's well-being and health. In general, experiencing positive emotions is good for us, whereas experiencing negative emotions is bad for us. However, recent research on emotions and well-being suggests this simple conclusion is incomplete and sometimes even wrong. Taking a closer look at this research, the present module provides a more complex relationship between emotion and well-being. At least three aspects of the emotional experience appear to affect how a given emotion is linked with well-being: the intensity of the emotion experienced, the fluctuation of the emotion experienced, and the context in which the emotion is experienced. While it is generally good to experience more positive emotion and less negative emotion, this is not always the guide to the good life.

Learning Objectives

- Describe the general pattern of associations between emotion experience and well-being.
- Identify at least three aspects of emotion experience beyond positivity and negativity of the emotion that affect the link between emotion experience and well-being.

How we feel adds much of the flavor to life's highest—and lowest—moments. Can you think of an important moment in your life that didn't involve strong feelings? In fact, it might be hard to recall *any* times when you had no feeling at all. Given how saturated human life is with feelings, and given how profoundly feelings affect us, it is not surprising that much theorizing and research has been devoted to uncovering how we can optimize our feelings, or, "emotion experiences," as they are referred to in psychological research.

Feelings contribute to well-being



Although we tend to think we should always strive for “positive” or “feel-good” emotions, in some situations a negative emotion might be best. For example feeling disappointment when experiencing a failure might help motivate you for future success.

[Image: CC0 Public Domain, <https://goo.gl/m25gce>]

So, which **emotions** are the “best” ones to feel? Take a moment to think about how you might answer this question. At first glance, the answer might seem obvious. Of course, we should experience as much positive emotion and as little negative emotion as possible! Why? Because it is pleasant to experience positive emotions and it is unpleasant to experience negative emotions (**Russell & Barrett, 1999**). The conclusion that positive feelings are

good and negative feelings are bad might seem so obvious as not to even warrant the question, much less bona fide psychological research. In fact, the very labels of “positive” and “negative” imply the answer to this question. However, for the purposes of this module, it may be helpful to think of “positive” and “negative” as descriptive terms used to discuss two different types of experiences, rather than a true value judgment. Thus, whether positive or negative emotions are good or bad for us is an empirical question.

As it turns out, this empirical question has been on the minds of theorists and researchers for many years. Such psychologists as Alice Isen, Charles Carver, Michael Scheier, and, more recently, Barbara Fredrickson, Dacher Keltner, Sonja Lyubomirsky, and others began asking whether the effects of feelings could go beyond the obvious momentary pleasure or displeasure. In other words, can emotions do more for us than

simply make us feel good or bad? This is not necessarily a new question; variants of it have appeared in the texts of thinkers such as Charles Darwin (1872) and Aristotle (1999). However, modern psychological research has provided empirical evidence that feelings are not just inconsequential byproducts. Rather, each emotion experience, however fleeting, has effects on cognition, behavior, and the people around us. For example, feeling happy is not only pleasant, but is also useful to feel when in social situations because it helps us be friendly and collaborative, thus promoting our positive relationships. Over time, the argument goes, these effects add up to have tangible effects on people's **well-being** (good mental and physical health).

A variety of research has been inspired by the notion that our emotions are involved in, and maybe even causally contribute to, our well-being. This research has shown that people who experience more frequent positive emotions and less frequent negative emotions have higher well-being (e.g., **Fredrickson, 1998; Lyubomirsky, King, & Diener, 2005**), including increased life satisfaction (**Diener, Sandvik, & Pavot, 1991**), increased physical health (**Tugade, Fredrickson, & Barrett, 2004; Veenhoven, 2008**), greater resilience to stress (**Folkman & Moskowitz, 2000; Tugade & Fredrickson, 2004**), better social connection with others (**Fredrickson, 1998**), and even longer lives (**Veenhoven, 2008**). Notably, the effect of positive emotion on longevity is about as powerful as the effect of smoking! Perhaps most importantly, some research directly supports that emotional experiences *cause* these various outcomes rather than being just a consequence of them (**Fredrickson, Cohn, Coffey, Pek, & Finkel, 2008; Lyubomirsky et al., 2005**).

At this point, you might be tempted to conclude that you should always strive to experience as much positive emotion and as little negative emotion as possible. However, recent research suggests that this conclusion may be premature. This is because this conclusion neglects three central aspects of the emotion experience. First, it neglects the intensity of the emotion: Positive and negative emotions might not have the



Not only do the emotions we feel vary by the context, but also the emotions we should feel depend on the circumstances, too. [Image: puppywind, <https://goo.gl/BQKhKK>, CC BY-NC-ND 2.0, <https://goo.gl/h9gK3o>]

same effect on well-being at all intensities. Second, it neglects how emotions fluctuate over time: Stable emotion experiences might have quite different effects from experiences that change a lot. Third, it neglects the context in which the emotion is experienced: The context in which we experience an emotion might profoundly affect whether the emotion is good or bad for us. So, to address the question “Which emotions should we feel?” we must answer, “It depends!” We next consider each of the three aspects of feelings, and how they influence the link between feelings and well-being.

The intensity of the emotion matters

Experiencing more *frequent* positive emotions is generally beneficial. But does this mean that we should strive to feel as *intense* positive emotion as possible? Recent research suggests that this unqualified conclusion might be wrong.

In fact, experiencing very high levels of positive emotion may

be harmful (**Gruber, 2011; Oishi, Diener, & Lucas, 2007**). For instance, experiencing very high levels of positive emotion makes individuals more likely to engage in risky behaviors, such as binge eating and drug use (**Cyders & Smith, 2008; Martin et al., 2002**). Furthermore, intense positive emotion is associated with the experience of mania (**Gruber et al., 2009; Johnson, 2005**). It appears that the experience of positive emotions follows an inverted U-shaped curve in relation to well-being: more positive emotion is linked with increased well-being, but only up to a point, after which even more positive emotion is linked with decreased well-being (**Grant & Schwartz, 2011**). These empirical findings underscore the sentiment put forth long ago by the philosopher Aristotle: Moderation is key to leading a good life (**1999**).

Too much positive emotion may pose a problem for well-being. Might too little negative emotion similarly be cause for concern? Although there is limited empirical research on this subject, initial research suggests supports this idea. For example, people who aim *not* to feel negative emotion are at risk for worse well-being and adaptive functioning, including lower life satisfaction, lower social support, worse college grades, and feelings of worse physical health (**Tamir & Ford, 2012a**). Similarly, feeling too little embarrassment in response to a social faux pas may damage someone's social connections if they aren't motivated by their embarrassment to make amends (**Keltner & Buswell, 1997**). Low levels of negative emotion also seem to be involved in some forms of psychopathology. For instance, blunted sadness in response to a sad situation is a characteristic of major depressive disorder (**Rottenberg, Gross, & Gotlib, 2005**) and feeling too little fear is a hallmark of psychopathy (**Marsh et al., 2008; Patrick, 1994**).

In sum, this first section suggests that the conclusion "Of course we should experience as much positive emotions and as little negative emotions as possible" is sometimes wrong. As

it turns out, there can be too much of a good thing and too little of a bad thing.

The fluctuation of the emotion matters

Emotions naturally vary—or fluctuate—over time (Davidson, 1998). We probably all know someone whose emotions seem to fly everywhere—one minute they're ecstatic, the next they're upset. We might also know a person who is pretty even-keeled, moderately happy, with only modest fluctuations across time. When looking only at average emotion experience, say across a month, both of these people might appear identical:



Throughout our lives, our emotions vary such that we experience great highs and great lows. However, if you average those emotions over time, we tend to end up somewhere in the middle.
[Image: Moazzam Brohi, <https://goo.gl/acZniv>, CC BY 2.0, <https://goo.gl/BRvSA7>]

moderately happy. However, underlying these identical averages are two very different patterns of fluctuation across time. Might these **emotion fluctuations** across time—beyond average intensity—have implications for well-being?

Overall, the available research suggests that how much emotions fluctuate does indeed matter. In general, greater fluctuations are associated with worse well-being. For example, higher fluctuation of positive emotions—measured either within a single day or across two weeks—was linked with lower well-being and greater depression (Gruber, Kogan, Quoidbach, & Mauss, 2013). Fluctuation in negative emotions, in turn, has been linked with increased depressive symptoms (Peeters,

Berkhof, Delespaul, Rottenberg, & Nicolson, 2003), borderline personality disorder (**Trull et al., 2008**), and neuroticism (**Eid & Diener, 1999**). These associations tend to hold even when controlling for average levels of positive or negative emotion, which means that beyond the overall intensity of positive or negative emotion, the fluctuation of one's emotions across time is associated with well-being. While it is not entirely clear why fluctuations are linked to worse well-being, one explanation is that strong fluctuations are indicative of emotional instability (**Kuppens, Oravecz, & Tuerlinckx, 2010**).

Of course, this should not be taken to mean that we should rigidly feel the exact same way every minute of every day, regardless of context. After all, psychological flexibility—or the ability to adapt to changing situational demands and experience emotions accordingly—has generally demonstrated beneficial links with well-being (Bonanno, Papa, Lalande, Westphal, & Coifman, **2004**; **Kashdan, & Rottenberg, 2010**). The question remains, however: what exact amount of emotional fluctuation constitutes unhealthy instability and what amount of emotional fluctuation constitutes healthy flexibility.

Again, then, we must qualify the conclusion that it is always better to experience more positive emotions and less negative emotions. The degree to which emotions fluctuate across time plays an important role. Overall, relative stability (but not rigidity) in emotion experience appears to be optimal for well-being.

The context of the emotion experience matters

This module has already discussed two features of emotion experiences that affect how they relate to well-being: the

intensity of the emotion and the fluctuation of the emotion over time. However, neither of these features takes into account the context in which the emotion is experienced. At least three different contexts may critically affect the links between emotion and well-being: (1) the external environment in which the emotion is being experienced, (2) the other emotional responses (e.g., physiology, facial behavior) that are currently activated, and (3) the other emotions that are currently being experienced.

The external environment



Feeling an emotion that matches the person's context (e.g., experiencing happiness at a birthday party) is typically the most functional or beneficial emotion to feel. [Image: OakleyOriginals, <https://goo.gl/Ixflsq>, CC BY 2.0, <https://goo.gl/BRvSA7>]

Emotions don't occur within a vacuum. Instead, they are usually elicited by and experienced within specific situations that come in many shapes and sizes—from birthday parties to funerals, job interviews to mundane movie nights. The situation in which an emotion is experienced has strong implications for whether a given emotion is the “best” emotion to feel. Take happiness, for example. Feeling happiness at a birthday party may be a great idea. However, having the

exact same experience of happiness at a funeral would likely not bode well for your well-being.

When considering how the environment influences the link between emotion and well-being, it is important to understand

that each emotion has its own function. For example, although fear is a negative emotion, fear helps us notice and avoid threats to our safety (Öhman & Mineka, 2001), and may thus be the “best” emotion to feel in dangerous situations. Happiness can help people cooperate with others, and may thus be the best emotion to feel when we need to collaborate (e.g., Van Kleef, van Dijk, Steinel, & van Beest, 2008). Anger can energize people to compete or fight with others, and may thus be advantageous to experience it in confrontations (e.g., Tamir & Ford, 2012b; Van Kleef et al., 2008). It might be disadvantageous to experience happiness (a positive emotion) when we need to fight with someone; in this situation, it might be better to experience anger (a negative emotion). This suggests that emotions’ implications for well-being are not determined only by whether they are positive or negative but also by whether they are well-matched to their context.

In support of this general idea, people who experience emotions that fit the context at hand are more likely to recover from depression and trauma (Bonanno et al., 2004; Rottenberg, Kasch, Gross, & Gotlib, 2002). Research has also found that participants who want to feel emotions that match the context at hand (e.g., anger when confronting someone)—even if that emotion was negative—are more likely to experience greater well-being (Tamir & Ford, 2012a). Conversely, people who pursue emotions without regard to context—even if those emotions are positive, like happiness—are more likely to experience lower subjective well-being, more depression, greater loneliness, and even worse grades (Ford & Tamir, 2012; Mauss et al., 2012; Mauss, Tamir, Anderson, & Savino, 2011; Tamir & Ford, 2012a).

In sum, this research demonstrates that regardless of whether an emotion is positive or negative, the context in which it is experienced critically influences whether the emotion helps or hinders well-being.

Other emotional responses



If we experience the emotion of amusement (from seeing something funny), we often have the physiological response to laugh. This is an example of emotion coherence, where we express a particular behavior associated with a particular emotion. [Image: Ed Schipul, <https://goo.gl/7NUYmR>, CC BY-SA 2.0, <https://goo.gl/rxiUsF>]

The subjective experience of an emotion—what an emotion *feels* like—is only one aspect of an emotion. Other aspects include behaviors, facial expressions, and physiological activation (Levenson, 1992). For example, if you feel excited about having made a new friend, you might want to be near that person, you might smile, and your heart might be beating faster as you do so. Often, these different responses travel together, meaning that when we feel

an emotion we *typically* have corresponding behaviors and physiological responses (e.g., Ekman, 1972; Levenson, 1992). The degree to which responses travel together has sometimes been referred to as **emotion coherence** (Mauss, Levenson, McCarter, Wilhelm, & Gross, 2005). However, these different responses do not co-occur in all instances and for all people (Bradley & Lang, 2000; Mauss et al., 2005; for review, see Fridlund, Ekman, & Oster, 1987). For example, some people may choose not to express an emotion they are feeling internally (English & John, 2013), which would result in lower coherence.

Does coherence—above and beyond emotion experience per se—matter for people's well-being? To examine this question, one study measured participants' emotion coherence by showing them a funny film clip of stand-up comedy while recording their experience of positive emotion as well as their

behavioral displays of positive emotion (**Mauss, Shallcross, et al., 2011**). As predicted, participants differed quite a bit in their coherence. Some showed almost perfect coherence between their behavior and experience, whereas others' behavior and experience corresponded not much at all. Interestingly, the more that participants' behavior and experience cohered in the laboratory session, the lower levels of depressive symptoms and the higher levels of well-being they experienced 6 months later. This effect was found when statistically controlling for overall intensity of positive emotions experienced. In other words, experiencing high levels of positive emotion aided well-being *only if it was accompanied by corresponding positive facial expressions*.

But *why* would coherence of different emotional responses predict well-being? One of the key functions of an emotion is social communication (**Keltner & Haidt, 1999**), and arguably, successful social communication depends on whether an individual's emotions are being *accurately* communicated to others. When someone's emotional behavior doesn't match their experience it may disrupt communication because it could make the individual appear confusing or inauthentic to others. In support of this theory, the above study found that lower coherence was associated with worse well-being because people with lower coherence felt less socially connected to others (**Mauss, Shallcross, et al., 2011**). These findings are also consistent with a large body of research examining the extent to which people mask the outward display of an emotional experience, or *suppression*. This research has demonstrated that people who habitually use suppression not only experience worse well being (**Gross & John, 2003**), but they also seem to be particularly worse off with regard to their social relationships (**Srivastava, Tamir, McGonigal, John, & Gross, 2009**).

These findings underscore the importance of examining whether an individual's experience is traveling together with

his or her emotional responses, above and beyond overall levels of subjective experience. Thus, to understand how emotion experiences predict well-being, it is important not only to consider the experience of an emotion, but also the other emotional responses currently activated.

Other emotions

Up until now, we have treated emotional experiences as though people can only experience one emotion at a time. However, it should be kept in mind that positive and negative emotions are not simply the opposite of one another. Instead, they tend to be independent of one another, which means that a person can feel positive and negative emotions at the same time (**Larsen, McGraw, Mellers, & Cacioppo, 2004**). For example, how does it feel to win a prize when you expected a greater prize? Given “what might have been,” situations like this can elicit both happiness and sadness. Or, take “schadenfreude” (a German term for deriving pleasure from someone else’s misfortune), or “aviman” (an Indian term for prideful, loving anger), or nostalgia (an English term for affectionate sadness about something from the past): these terms capture the notion that people can feel both positively and negatively within the same emotional experience. And as it turns out, the other emotions that someone feels (e.g., sadness) during the experience of an emotion (e.g., happiness) influence whether that emotion experience has a positive or negative effect on well-being.

Importantly, the extent to which someone experiences different emotions at the same time—or *mixed emotions*—may be beneficial for their well-being. Early support for this theory was provided by a study of bereaved spouses. In the study, participants were asked to talk about their recently deceased spouse, which undoubtedly elicited strong negative emotions. However, some participants



What experiences can you recall where you felt mixed emotions? Happiness and disappointment? Hope and fear? Admiration and envy? [Image: Ron Cogswell, <https://goo.gl/JKuzmU>, CC BY 2.0, <https://goo.gl/BRvSA7>]

expressed positive emotions in addition to the negative ones, and it was those participants who recovered more quickly from their loss (**Bonanno & Keltner, 1997**). A recent study provides additional support for the benefits of mixed emotions, finding that adults who experienced more mixed emotions over a span of 10 years were physically healthier than adults whose experience of mixed emotions did not increase over time (**Hershfield, Scheibe, Sims & Carstensen, 2013**). Indeed, individuals who can experience positive emotions even in the face of negative emotions are more likely to cope successfully with stressful situations (**Larsen, Hemenover, Norris, & Cacioppo, 2003**).

Why would mixed emotions be beneficial for well-being? Stressful situations often elicit negative emotions, and recall that negative emotions have some benefits, as we outlined above. However, so do positive emotions, and thus having the ability to “take the good with the bad” might be another key component of well-being. Again, experiencing more positive emotion and less negative emotion may not always be optimal. Sometimes, a combination of both may be best.

Conclusion

Are emotions just fleeting experiences with no consequence beyond our momentary comfort or discomfort? A variety of research answers a firm “no”—emotions are integral predictors of our well-being. This module examined how, exactly, emotion experience might be linked to well-being. The obvious answer to this question is: *of course*, experiencing as much positive emotions and as little negative emotions as possible is good for us. But although this is true in general, recent research suggests that this obvious answer is incomplete and sometimes even wrong. As philosopher Robert Solomon said, “Living well is not just maximizing the good feelings and minimizing the bad. (...) A happy life is not necessarily filled with happy moments” (2007, p. 86).

Check Your Knowledge

To help you with your studying, we’ve included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Emotion

An experiential, physiological, and behavioral response to a personally meaningful stimulus.

Emotion coherence

The degree to which emotional responses (subjective

experience, behavior, physiology, etc.) converge with one another.

Emotion fluctuation

The degree to which emotions vary or change in intensity over time.

Well-being

The experience of mental and physical health and the absence of disorder.

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50. Affective Neuroscience

Original chapter by Eddie Harmon-Jones and Cindy Harmon-Jones adapted by the Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

This module provides a brief overview of the neuroscience of emotion. It integrates findings from human and animal research to describe the brain networks and associated neurotransmitters involved in basic affective systems.

Learning Objectives

- Define affective neuroscience.
- Describe neuroscience techniques used to study emotions in humans and animals.
- Name five emotional systems and their associated neural structures and neurotransmitters.
- Give examples of exogenous chemicals (e.g., drugs) that influence affective systems, and discuss their effects.
- Discuss multiple affective functions of the amygdala and

the nucleus accumbens.

- Name several specific human emotions, and discuss their relationship to the affective systems of nonhuman animals.

Affective Neuroscience: What is it?

Affective neuroscience examines how the brain creates emotional responses. Emotions are psychological phenomena that involve changes to the body (e.g., facial expression), changes in autonomic nervous system activity, feeling states (subjective responses), and urges to act in specific ways (motivations; **Izard, 2010**). Affective **neuroscience** aims to understand how matter (brain structures and chemicals) creates one of the most fascinating aspects of mind, the emotions. Affective neuroscience uses unbiased, observable measures that provide credible evidence to other sciences and laypersons on the importance of emotions. It also leads to biologically based treatments for affective disorders (e.g., depression).



Although we all experience emotions all the time, they are very difficult to describe and study. Fortunately, technological advances are making this easier.
 [Image: Waag Society, <https://goo.gl/F0KdnB>, CC BY-NC-SA 2.0, <https://goo.gl/iF4hmM>]

The human brain and its responses, including emotions, are complex and flexible. In comparison, nonhuman animals possess simpler nervous systems and more basic emotional responses. Invasive neuroscience techniques, such as electrode implantation, lesioning, and hormone administration, can be more easily used in animals than in humans. Human neuroscience must rely primarily on noninvasive techniques such as electroencephalography

(EEG) and functional magnetic resonance imaging (fMRI), and on studies of individuals with brain lesions caused by accident or disease. Thus, animal research provides useful models for understanding affective processes in humans. Affective circuits found in other species, particularly social mammals such as rats, dogs, and monkeys, function similarly to human affective networks, although nonhuman animals' brains are more basic.

In humans, emotions and their associated neural systems have additional layers of complexity and flexibility. Compared to animals, humans experience a vast variety of nuanced and sometimes conflicting emotions. Humans also respond to these emotions in complex ways, such that conscious goals, values, and other cognitions influence behavior in addition to emotional responses. However, in this module we focus on the similarities between organisms, rather than the differences. We often use the term “organism” to refer to the individual who is experiencing an emotion or showing evidence of particular

neural activations. An organism could be a rat, a monkey, or a human.

Across species, emotional responses are organized around the organism's survival and reproductive needs. Emotions influence perception, cognition, and behavior to help organisms survive and thrive (**Farb, Chapman, & Anderson, 2013**). Networks of structures in the brain respond to different needs, with some overlap between different emotions. Specific emotions are not located in a single structure of the brain. Instead, emotional responses involve networks of activation, with many parts of the brain activated during any emotional process. In fact, the brain circuits involved in emotional reactions include nearly the entire brain (**Berridge & Kringelbach, 2013**). Brain circuits located deep within the brain below the cerebral cortex are primarily responsible for generating basic emotions (**Berridge & Kringelbach, 2013; Panksepp & Biven, 2012**). In the past, research attention was focused on specific brain structures that will be reviewed here, but future research may find that additional areas of the brain are also important in these processes.

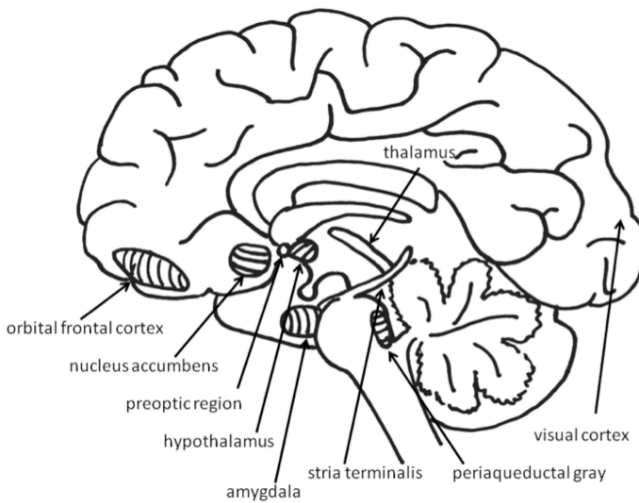


Figure 1: Structures in the brain

Basic Emotions

Desire: The neural systems of reward seeking

One of the most important affective neuronal systems relates to feelings of desire, or the appetite for rewards. Researchers refer to these appetitive processes using terms such as “wanting” (Berridge & Kringelbach, 2008), “seeking” (Panksepp & Biven, 2012), or “behavioural activation sensitivity” (Gray, 1987). When the appetitive system is aroused, the organism shows enthusiasm, interest, and curiosity. These neural circuits motivate the animal to move through its environment in search of rewards such as appetizing foods,

attractive sex partners, and other pleasurable stimuli. When the appetitive system is underaroused, the organism appears depressed and helpless.

Much evidence for the structures involved in this system comes from animal research using direct brain stimulation. When an electrode is implanted in the lateral **hypothalamus** or in cortical or mesencephalic regions to which the hypothalamus is connected, animals will press a lever to deliver electrical stimulation, suggesting that they find the stimulation pleasurable. The regions in the desire system also include the amygdala, nucleus accumbens, and **frontal cortex** (Panksepp & Biven, 2012). The neurotransmitter dopamine, produced in the mesolimbic and mesocortical dopamine circuits, activates these regions. It creates a sense of excitement, meaningfulness, and anticipation. These structures are also sensitive to drugs such as cocaine and amphetamines, chemicals that have similar effects to dopamine (Panksepp & Biven, 2012).

Research in both humans and nonhuman animals shows that the left frontal cortex (compared to the right frontal cortex) is more active during appetitive emotions such as desire and interest. Researchers first noted that persons who had suffered damage to the left frontal cortex developed depression, whereas those with damage to the right frontal cortex developed mania (Goldstein, 1939). The relationship



Just looking at an image of appealing food should increase the activity in your left frontal cortex. Yum! [Image: CC0 Public Domain, <https://goo.gl/m25gce>]

between left frontal activation and approach-related emotions has been confirmed in healthy individuals using EEG and fMRI

(Berkman & Lieberman, 2010). For example, increased left frontal activation occurs in 2- to 3-day-old infants when sucrose is placed on their tongues (Fox & Davidson, 1986), and in hungry adults as they view pictures of desirable desserts (Gable & Harmon-Jones, 2008). In addition, greater left frontal activity in appetitive situations has been found to relate to dopamine (Wacker, Mueller, Pizzagalli, Hennig, & Stemmler, 2013).

“Liking”: The neural circuits of pleasure and enjoyment

Surprisingly, the amount of desire an individual feels toward a reward need not correspond to how much he or she likes that reward. This is because the neural structures involved in the enjoyment of rewards are different from the structures involved in the desire for the rewards. “Liking” (e.g., enjoyment of a sweet liquid) can be measured in babies and nonhuman animals by measuring licking speed, tongue protrusions, and happy facial expressions, whereas “wanting” (desire) is shown by the willingness to work hard to obtain a reward (Berridge & Kringelbach, 2008). Liking has been distinguished from wanting in research on topics such as drug abuse. For example, drug addicts often desire drugs even when they know that the ones available will not provide pleasure (Stewart, de Wit, & Eikelboom, 1984).

Research on liking has focused on a small area within the **nucleus accumbens** and on the posterior half of the ventral pallidum. These brain regions are sensitive to opioids and endocannabinoids. Stimulation of other regions of the reward system increases wanting, but does not increase liking, and in some cases even decreases liking. The research on the distinction between desire and enjoyment contributes to the

understanding of human addiction, particularly why individuals often continue to frantically pursue rewards such as cocaine, opiates, gambling, or sex, even when they no longer experience pleasure from obtaining these rewards due to habituation.

The experience of pleasure also involves the orbitofrontal cortex. Neurons in this region fire when monkeys taste, or merely see pictures of, desirable foods. In humans, this region is activated by pleasant stimuli including money, pleasant smells, and attractive faces (Gottfried, O'Doherty & Dolan, 2002; O'Doherty, Deichmann, Critchley, & Dolan, 2002; O'Doherty, Kringelbach, Rolls, Hornak, & Andrews, 2001; O'Doherty, Winston, Critchley, Perrett, Burt, & Dolan, 2003).

Fear: The neural system of freezing and fleeing

Fear is an unpleasant emotion that motivates avoidance of potentially harmful situations. Slight stimulation of the fear-related areas in the brain causes animals to freeze, whereas intense stimulation causes them to flee. The fear circuit extends from the central amygdala to the **periaqueductal gray** in the midbrain. These structures are sensitive to glutamate, corticotrophin releasing factor, adrenocortico-trophic hormone, cholecystokinin, and several different neuropeptides. Benzodiazepines and other tranquilizers inhibit activation in these areas (**Panksepp & Biven, 2012**).



Because fear is so important for our survival (i.e., fear informs us when something threatens us), our brains are able to “recognize” frightening stimuli before we ourselves are even consciously aware of them. [Image: CC0 Public Domain, <https://goo.gl/m25gce>]

The role of the **amygdala** in fear responses has been extensively studied. Perhaps because fear is so important to survival, two pathways send signals to the amygdala from the sensory organs. When an individual sees a snake, for example, the sensory information travels from the eye to the **thalamus** and then to the visual cortex. The **visual cortex** sends the information on to the amygdala, provoking a fear response. However, the thalamus also quickly sends the information straight to the amygdala, so that the organism can react before consciously perceiving the snake (**LeDoux, Farb, & Ruggiero, 1990**). The pathway from the thalamus to the amygdala is fast

but less accurate than the slower pathway from the visual cortex. Damage to the amygdala or areas of the ventral hippocampus interferes with fear conditioning in both humans and nonhuman animals (**LeDoux, 1996**).

Rage: The circuits of anger and attack

Anger or rage is an arousing, unpleasant emotion that motivates organisms to approach and attack (**Harmon-Jones, Harmon-Jones, & Price, 2013**). Anger can be evoked through goal frustration, physical pain, or physical restraint. In territorial animals, anger is provoked by a stranger entering the organism's home territory (**Blanchard & Blanchard, 2003**). The neural networks for anger and fear are near one another, but separate (**Panksepp & Biven, 2012**). They extend from the medial amygdala, through specific parts of the hypothalamus, and into the periaqueductal gray of the midbrain. The anger circuits are linked to the appetitive circuits, such that lack of an anticipated reward can provoke rage. In addition, when humans are angered, they show increased left frontal cortical activation, supporting the idea that anger is an approach-related emotion (**Harmon-Jones et al., 2013**). The neurotransmitters involved in rage are not yet well understood, but Substance P may play an important role (**Panksepp & Biven, 2012**). Other neurochemicals that may be involved in anger include testosterone (**Peterson & Harmon-Jones, 2012**) and arginine-vasopressin (**Heinrichs, von Dawans, & Domes, 2009**). Several chemicals inhibit the rage system, including opioids and high doses of antipsychotics, such as chlorpromazine (**Panksepp & Biven, 2012**).

Love: The neural systems of care and

attachment



Just as scientists today distinguish between types of love like “romantic” and “parental,” so did the ancient Greeks who used the terms “eros” and “storge.” [Image: Go-tea 郭天, <https://goo.gl/KLFxJP>, CC BY 2.0, <https://goo.gl/zHmGV2>]

For social animals such as humans, attachment to other members of the same species produces the positive emotions of attachment: love, warm feelings, and affection. The emotions that motivate nurturing behavior (e.g., maternal care) are distinguishable from those that motivate staying close to an attachment figure in order to receive care and protection (e.g., infant attachment). Important regions for maternal nurturing include the

dorsal **preoptic area** (Numan & Insel, **2003**) and the bed nucleus of the **stria terminalis** (Panksepp, **1998**). These regions overlap with the areas involved in sexual desire, and are sensitive to some of the same neurotransmitters, including oxytocin, arginine-vasopressin, and endogenous opioids (endorphins and enkephalins).

Grief: The neural networks of loneliness and panic

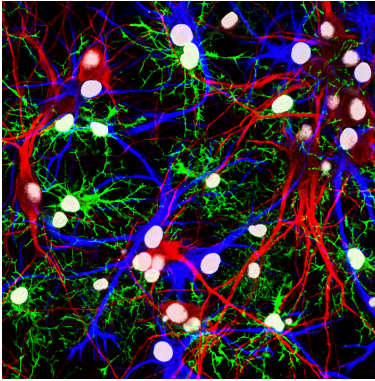
The neural networks involved in infant attachment are also sensitive to separation. These regions produce the painful emotions of grief, panic, and loneliness. When infant humans or other infant mammals are separated from their mothers,

they produce distress vocalizations, or crying. The attachment circuits are those that cause organisms to produce distress vocalizations when electrically stimulated.

The attachment system begins in the midbrain periaqueductal gray, very close to the area that produces physical pain responses, suggesting that it may have originated from the pain circuits (**Panksepp, 1998**). Separation distress can also be evoked by stimulating the dorsomedial thalamus, ventral septum, dorsal preoptic region, and areas in the bed nucleus of stria terminalis (near sexual and maternal circuits; Panksepp, Normansell, Herman, Bishop, & Crepeau, **1988**).

These regions are sensitive to endogenous opiates, oxytocin, and prolactin. All of these neurotransmitters *prevent* separation distress. Opiate drugs such as morphine and heroin, as well as nicotine, artificially produce feelings of pleasure and gratification, similar to those normally produced during positive social interactions. This may explain why these drugs are addictive. Panic attacks appear to be an intense form of separation distress triggered by the attachment system, and panic can be effectively relieved by opiates. Testosterone also reduces separation distress, perhaps by reducing attachment needs. Consistent with this, panic attacks are more common in women than in men.

Plasticity: Experiences can alter the brain



Neural plasticity can be summed up in the phrase: "Neurons that fire together, wire together." Or in other words, when certain emotions are paired with certain contexts, we learn to associate the two together. [Image: NICHD NIH, <https://goo.gl/T3PUlg>, CC BY 2.0, <https://goo.gl/BRvSA7>]

The responses of specific neural regions may be modified by experience. For example, the front shell of the nucleus accumbens is generally involved in appetitive behaviors, such as eating, and the back shell is generally involved in fearful defensive behaviors (Reynolds & Berridge, **2001, 2002**). Research using human neuroimaging has also revealed this front-back distinction in the functions of the nucleus accumbens (Seymour, Daw, Dayan, Singer, & Dolan, **2007**).

However, when rats are exposed to stressful environments, their fear-generating regions expand toward the front, filling almost 90% of the nucleus accumbens shell. On the other hand, when rats are exposed to preferred home environments, their fear-generating regions shrink and the appetitive regions expand toward the back, filling approximately 90% of the shell (Reynolds & Berridge, **2008**).

Brain structures have multiple functions

Although much affective neuroscience research has emphasized whole structures, such as the amygdala and nucleus accumbens, it is important to note that many of these

structures are more accurately referred to as complexes. They include distinct groups of nuclei that perform different tasks. At present, human neuroimaging techniques such as fMRI are unable to examine the activity of individual nuclei in the way that invasive animal neuroscience can. For instance, the amygdala of the nonhuman primate can be divided into 13 nuclei and cortical areas (**Freese & Amaral, 2009**). These regions of the amygdala perform different functions. The central nucleus sends outputs involving brainstem areas that result in innate emotional expressions and associated physiological responses. The basal nucleus is connected with striatal areas that are involved with actions such as running toward safety. Furthermore, it is not possible to make one-to-one maps of emotions onto brain regions. For example, extensive research has examined the involvement of the amygdala in fear, but research has also shown that the amygdala is active during uncertainty (**Whalen, 1998**) as well as positive emotions (**Anderson et al., 2003; Schulkin, 1991**).

Conclusion

Research in affective neuroscience has contributed to knowledge regarding emotional, motivational, and behavioral processes. The study of the basic emotional systems of nonhuman animals provides information about the organization and development of more complex human emotions. Although much still remains to be discovered, current findings in affective neuroscience have already influenced our understanding of drug use and abuse, psychological disorders such as panic disorder, and complex human emotions such as desire and enjoyment, grief and love.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Affect

An emotional process; includes moods, subjective feelings, and discrete emotions.

Amygdala

Two almond-shaped structures located in the medial temporal lobes of the brain.

Hypothalamus

A brain structure located below the thalamus and above the brain stem.

Neuroscience

The study of the nervous system.

Nucleus accumbens

A region of the basal forebrain located in front of the preoptic region.

Orbital frontal cortex

A region of the frontal lobes of the brain above the eye sockets.

Periaqueductal gray

The gray matter in the midbrain near the cerebral aqueduct.

Preoptic region

A part of the anterior hypothalamus.

Stria terminalis

A band of fibers that runs along the top surface of the thalamus.

Thalamus

A structure in the midline of the brain located between the midbrain and the cerebral cortex.

Visual cortex

The part of the brain that processes visual information, located in the back of the brain.

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PSYC 100 XVIII

INTERACTING WITH TOUGH CONTENT, SELF-CARE, AND WELLNESS

51. Navigating Principles of Psychology

By Jeremy G. Stewart & Melissa Milanovic

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen’s Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

This is a chapter that you’ve encountered already in this course. As we shift into content related to self-care, wellness, and psychopathology, and during this busy time of the academic year, we want to revisit this content with you.

Overview

Principles of Psychology (PSYC100) at Queen’s University is a course where we regularly hear that: a) students typically really enjoy the course, and b) students find the course challenging. The goal of this module is to provide an overview of some of the challenges of taking PSYC100 at Queen’s University and strategies to overcome them. In this chapter, we first describe what you know from experience: University life, in general, is at once exciting and demanding. The demands of University life provide the backdrop for the particular challenges that we think are most central to Principles of Psychology. We divide these challenges into those that have most to do with the academic content and those involving our emotional experiences while taking the course. We end by describing evidence-based strategies to overcome these academic and emotional challenges. We hope that this information will act as

a reference or starting point to set you up for the best possible outcomes in this course.

Learning Objectives

1. Describe factors that impact adjustment to post-secondary education, and that predict success.
2. Understand that psychology is a broad science that integrates diverse approaches and methodologies that have their roots in other disciplines (e.g., Biology, Mathematics, Philosophy).
3. Learn the scope of mental health problems faced by University students (including those enrolled in Principles of Psychology) and how that might affect working with course content.
4. Define trigger warnings and describe the existing evidence for why they are not used in Principles of Psychology.
5. Understand and use (where appropriate) strategies to overcome the academic challenges that this course may present.
6. Understand and use (where appropriate) strategies to overcome the emotional challenges that this course may present.

University Life

Attending university is unquestionably a privilege. For many, their university years are a momentous period wherein their lives are enriched academically, socially, and emotionally. These years are rife with change; many people transition from late adolescence dependent on parents and/or other caregivers to adults entering the workforce to begin their careers. Along with excitement and opportunity, university life also brings a slew of normative demands and stressors. The approaches you take to navigating the academic and emotional challenges of this

course, in particular, need to be weighed in the context of adjustment to university life in general.

There is now a large research literature on **academic adjustment**, defined as one's ability to adequately cope with the demands of post-secondary education. The concept encompasses much more than doing well in courses; it also includes one's motivation to learn, satisfaction with University life, and a sense of goals and purpose (e.g., Baker & Siryk, 1986). It also includes non-academic factors, particularly one's social and emotional adaptation to University.

Not surprisingly, better academic adjustment predicts degree completion and academic achievement (Brady-Amoon & Fuentes, 2011; Gerdes & Mallinckrodt, 1994). That said, if you are in your first year (or even upper years), there are a number of challenges that you may be navigating that can impact your adjustment. These include, but are not limited to:

- Loneliness. This state of mind may be attributed to separation from family, high school and/or hometown friends, and other important people in your life.
- Financial stress. University is expensive and you may be faced with debt, the need to reduce expenses, and/or needing to increase income (e.g., through a part-time job).
- Class format. Many university classes are large (each PSYC100 section has at least 400 students formally enrolled), somewhat impersonal, and have less structure than a typical high school classroom. This format creates many challenges, including opportunities for distraction.
- Freedom. Most students have much more independence in university than they did before. With freedom and flexibility comes the need to regulate key aspects of your life, including sleep, diet, study schedule, and exercise.
- Social opportunities. University involves meeting new people with experiences, beliefs, and passions that may substantially diverge from your own. This opportunity is

exciting and leads to forming new peer groups and relationships. At the same time, there is a need to choose whether or not to engage in certain recreation activities, and more broadly, how to balance one's work life and social life.

- Personal and emotional problems. From a developmental perspective, the years during which many attend undergraduate university programs – between late adolescence and late 20s – are critical for developing personal values, beliefs, and goals, as well as intimate, trusting relationships (e.g., Erikson, 1963). Questioning one's purpose, self-worth, relationships, etc. is normal. That said, doing so can also contribute to emotional turmoil and personal crises (more on personal and emotional challenges below).

In sum, the challenges of this Introductory Psychology course, or any course you might take, do not occur in a vacuum, but instead exist in the context of the many other demands that university life presents. This point is important to remember. We are not suggesting that PSYC100 is the only challenge in your life (we are sure that is far from true) and we do not believe that the strategies we suggest for navigating the course are “one size fits all”. We hope to shed light on some of the more common barriers, and provide a useful starting point for building a set of individualized skills and strategies.

Challenges in Principles of Psychology

At Queen's University (and, we suspect, at many other institutions) Principles of Psychology is not a “bird course” (i.e., a course in which it is very easy to get a high grade). In fact, www.birdcourses.com rates the course a “C” for “birdiness” — their scale is the academic letter grade system, with F being the most difficult / least “birdy” course — based on input from students who have taken it in the past decade. Overall, we agree with this assessment – from our perspective, Principles

of Psychology is one of the more rewarding and interesting courses offered at Queen's. However, part of what makes it this way is also why it presents both academic and emotional challenges for students.

Academic Challenges

Psychology is a science. Perhaps the most common source of academic difficulties in Principles of Psychology stems from a fundamental misunderstanding of what psychology is. Many find the degree to which topics like neuroanatomy, endocrinology, reproductive biology, genetics, statistics, and research methods (to name a few!) are emphasized in Principles of Psychology surprising. There is a misconception that knowledge of these topics is only relevant to “hard sciences” like Biology, Chemistry, Physics, Mathematics, etc. While understandable, this view is an unhelpful, false dichotomy that we strive to debunk in this course.

The study of psychology is firmly grounded in empiricism and the scientific method. In order to understand and interpret research in psychology, it is critical to have a firm grasp of research design, hypothesis testing, and statistics. Further, one of the most exciting things about Psychology is that it is multi-disciplinary. Our thoughts and behaviors are complex, and to understand them, scientists must draw on theory and methods from diverse disciplines. One example of drawing on information from diverse fields is the National Institute of Mental Health's influential Research Domain Criteria (RDoC) project. Launched in 2008, the RDoC framework has shaped how scientists study the causes and symptoms of mental illnesses. A core RDoC tenant is that mental illness must be classified and studied at multiple “units of analysis” (e.g., molecules, cells, brain circuits, behaviours). Guided by this comprehensive understanding of mental illness, scientists and clinicians have made breakthroughs in treatment and prevention.

What does all of this mean? The bottom line is that some

of the content in Principles of Psychology will overlap (and even extend) material that you may see in courses in Biology, Chemistry, Statistics, Mathematics, and others. For instance, you will learn about the anatomy and physiology of structures involved in sensation and perception, and about the statistical properties of a normal curve. Learning content that overlaps with a range of other disciplines is undoubtedly a tall order for students to tackle, but the variability and multi-disciplinary nature of psychological science is what makes it a fascinating and rewarding area of study.

Psychology is very broad. Related to the point above, Principles of Psychology covers considerable ground in the 24 weeks allotted to lectures and labs. Topics touch on many of the major disciplines in psychology, including Sensation and Perception, Clinical Psychology, Neuroscience, Developmental Psychology, Personality and Social Psychology, Learning/Behavioural Psychology, and Cognitive Psychology. These areas of psychology are in and of themselves very broad (indeed, our department devotes several upper year courses to each) and include multiple sub-disciplines. The course also touches on the history of psychology, research methods, and statistics. So, a lot to accomplish in a short period of time!

One challenging aspect is learning and mastering a lot of information. The diversity of topics covered makes this learning tricky, as you might feel as though you are “shifting gears” frequently, rather than cruising seamlessly from one content area to the next. This challenge makes students more flexible, efficient, and altogether better learners, and this is one of the benefits of studying psychology. So the potential added layer of difficulty in the short-term is worthwhile in the long term! Second, lectures, readings, learning labs, and quizzes will emphasize common threads or connections among course topics. We have made an effort to have content build on itself wherever possible, and to demonstrate how very diverse areas of psychology share common basic principles and themes.

Multiple Methods of Learning. Especially in the blended version of Principles of Psychology (students attend lecture), the material is presented and learned in several formats. Relative to traditional models, this instructional approach improves performance and attendance, partly because students prefer blended courses to traditional courses (Stockwell et al., 2015). However, active engagement with course material (e.g., preparing for and participating in learning labs; completing quizzes; preparing for lecture by reviewing and annotating textbook readings) takes time. It also is harder than passively absorbing content by simply “showing up” for weekly lectures and labs. Making full use of the different ways of learning offered in Principles of Psychology may mean prioritizing them regularly from week-to-week.

Fully benefitting from the richness Principles of Psychology demands organization, scheduling, and planning ahead. University life is busy and presents opportunities and challenges that you will be juggling while enrolled in this course. And Principles of Psychology is *only one of the courses* in which you are enrolled! Thus, in many ways, this course (and most others) asks you to reflect on what’s important to you and purposefully adjust your behavior so that it is in line with your priorities and goals. This reflection takes self-knowledge and maturity; it’s disarmingly difficult at times to act in a value-consistent manner. In fact, some psychotherapies aim to reduce symptoms of depression and anxiety in part by helping patients identify values and change behaviour in accordance with them (e.g., Acceptance and Commitment Therapy; Hayes, Strosahl, & Wilson, 2011). Structuring your time (see “Strategies to Overcome Academic Challenges” below) is a great place to start. If nothing else, it can make a proverbial mountain look more like a molehill, and is a good way to set yourself up for success in this course.

Emotional Challenges

Principles of Psychology may be more emotionally taxing

than many or all of your other courses. Generally, this response is because much of (but not all) of the content tackles *human processes* – how we perceive, think, feel, and behave. In short, the course content can be highly relatable, and you may make connections with what you’ve learned about yourself, your loved ones, and/or other important people in your life. In our experience, this relatability interacts with what students bring into the course. We can all probably think about significant hardships we’ve endured and moments in our lives that have tested us to our limits; we all bring our unique emotional histories. Here, we focus briefly on what we know about the mental health of university students and aspects of the course content that may be especially challenging for those with lived experience with mental illness.

University Mental Health. In late 2014, the World Health Organization’s (WHO) World Mental Health International College Student (WMH-ICS) surveys were launched. The initial round of surveys were completed by over 14,000 first-year university students across 19 institutions in 8 countries. The scope and rigor of these surveys has already provided unparalleled insight into the mental health of university students and the impact mental illness has on adjustment and functioning.

The results are sobering. More than 1 in 3 (35.3%) of first year students reported at least one diagnosable mental illness (according to the Diagnostic and statistical manual of mental disorders [4th ed.]; DSM-IV; American Psychiatric Association, 1994) in their lifetimes. Among these, the most common were Major Depressive Disorder (21.2%) and Generalized Anxiety Disorder (18.6%), mental illnesses characterized by low mood and/or a lack of pleasure and persistent, frequent anxiety, respectively. Although less common, alcohol and substance use disorders affected more than 1 in 5 students (Auerbach et al., 2018). Critically, more than 80% of these mental illnesses began prior to the start of university, and fewer than 1 in 5

students with at least one mental illness reported receiving even minimally adequate treatment in the year prior to being surveyed. Perhaps consequently, pre-matriculation mental illnesses are related to University attrition (Auerbach et al., 2016).

The WMH-ICS surveys also have shed light on how common suicidal thoughts and behaviors may be among incoming students. In their lifetimes, nearly one-third (32.7%) of students reported seriously thinking of killing themselves on purpose (i.e., suicidal ideation) while 17.5% (more than 1 in 6) reported having made a plan to die by suicide (e.g., what method they would use and where they would do it). Finally, *before starting University*, more than 1 in 25 students (4.3%) reported having done something to purposefully injure themselves with some intent to die by their own hands (i.e., a suicide attempt) (Mortier et al., 2018). Further, an additional 4.8% to 6.4% of students experienced *first onsets* of suicidal thoughts or behaviours during university annually (Mortier et al., 2016). That means that each year, we would expect approximately 1 in 5 students who had never experienced suicidal thoughts and behaviours in their lives to first report them in any given university year.

These are alarming statistics. It may not be surprising that the presence of mental illness(es) and/or suicidal thoughts and behaviours are associated with poorer academic performance (Bruffaerts et al., 2018; Mortier et al., 2015) and not completing one's program of study (Auerbach et al., 2016). However, mental illness and suicide can impact our lives in indirect ways, even if we are not personally coping with these. Given how widespread these problems are, if we ourselves are not experiencing symptoms related to mental illness and/or suicidal thoughts and behaviours, someone we love and are very close to—a parent, sibling, partner, friend—certainly is.

There are two take-home points from this discussion. First, mental health problems are common. If you are coping with them, you certainly aren't alone. Research suggests that

mental illness reduces student academic success and adjustment in university overall, but very few people receive the treatment that might help. Accessing personal support systems and professional help will increase your ability to navigate university life (see strategies below as well). Second, your lived experiences with symptoms related to mental illness will provide a unique lens through which to view the material; it may also leave you open to strong and/or unexpected reactions to aspects of the course content. It's impossible to predict what may be most jarring; nonetheless, below we turn to some notable parts of the course content that may be most emotionally challenging.

Course content. As much of the content of Principles of Psychology concerns the study of *us* – what we think and feel, how we act, and what we experience – parts of the material may resonate with you deeply. Indeed, we hope this is the case! The potential downside is you may come across content that you find challenging or activating.

Given the prevalence of mental illness and suicide in the general population, an obvious area in which you may face some tough course content is the Clinical Psychology section. This section will: give a broad overview of the history of mental illness; cover the symptoms, course, and causes of several psychiatric conditions; and discuss available treatments. Hearing about the specific symptoms of mental illnesses and the impacts these can have on people's lives can remind us of our own personal experiences and/or what our loved ones have been through. In general, hearing about precursors to psychiatric symptoms – for example, child abuse, major traumatic events (e.g., being the victim of violence), and substance use – can be upsetting. Hearing about the hardships people face and the fundamental inequalities that can bring on and perpetuate mental illness can be moving. A challenge of this course, and this section in particular, is noticing how these things impact us, taking care of ourselves as needed,

and using our experiences as fuel for our scholarship. These challenges are tricky to accomplish, and we provide some strategies that could prove helpful below.

The emotional challenges of the course content do not end necessarily with the Clinical Psychology section. For example, a major topic in Social Psychology concerns how people create “in groups” (others with whom one feels they have a lot in common) and “out groups” (others who share few of one’s broad characteristics and/or beliefs). Creating these dichotomies has an important evolutionary and interpersonal function. Nonetheless, our tendency to think in terms of “in groups” and “out groups” can contribute to stereotypes, bigotry, and hatred. Many of us and particularly those with lived experience of discrimination may find this difficult to discuss and learn about. As another example, a large and vibrant area of research in Developmental Psychology concerns how children form caring relationships with their parents, and how those relationships are fostered (or thwarted) by parenting practices over time. Learning about attachment styles (e.g., Bowlby, 1969) can be quite provocative depending on your experiences with being cared for and parented when you were young.

The key take away is that, more than many other courses, the content within Principles of Psychology may trigger strong feelings and reactions. We think that the strong emotions psychology may generate is a strength of psychology and something that can make it intrinsically fascinating. We also think that the potential for content to be provocative is something to keep in the back of your mind and watch in a very purposeful way (see more below).

Strategies for Successfully Navigating this Course

Strategies to Overcome Academic Challenges

The change from a high school to university course load can feel dramatic. Suddenly there are extensive readings to complete each week, assignments to stay on top of, and

examinations to prepare for, across multiple courses. It can be easy to become overwhelmed with the amount of academic material to manage. The following are some strategies to help manage your academic demands to help facilitate your ability to manage your time effectively.

Scheduling your time. It is very helpful to get into the habit of creating a weekly schedule. This scheduling not only helps you to sort out what work you plan to focus on each week, and when, but also ensures you are scheduling balanced activities into your life outside of your academics. Having a schedule can lead you to be more productive with your time and manage feelings of being overwhelmed by all of the things you need to do each week.

The Student Academic Success Services at Queen's University provides a helpful technique for generating a weekly schedule (<http://sass.queensu.ca/wp-content/uploads/2019/02/Weekly-Schedule-Template-2019.docx.pdf>) that helps you to make sure you are scheduling your time to include all of your fixed commitments (such as classes, appointments, and team meetings), health habits (such as eating, sleeping, exercise and relaxing), time for homework and everything else (including grocery shopping, laundry, and socializing).

Keeping focused. Do you get easily distracted? Perhaps when you sit down to do some work, your mind wanders to all the other things you need to do, such as “will I remember to text my friend later to hang out?” or “I have to remember to do that online quiz before tomorrow night”. Using a distraction pad to write down wandering thoughts and to-do items while you are working can help you to make sure you are not forgetting anything important, by writing them down for later. This practice also keeps you from getting distracted by going to do the task that has popped into your mind while working on something else.

Getting distracting thoughts out of your head by writing them down on paper can help you focus on the task at hand.

You can then set a specific time each evening to review your distraction pad, at which time you can decide which items are insignificant and can be forgotten, and which items are important. You can then turn the important items into specific actions, and plan for when you will tackle them by slotting them into your weekly schedule.

Not only can your thoughts distract you from attending to your work, but electronic devices also can be very distracting. It is important that each time you sit down to complete a session of work, you decide if you need your digital device in order to do it. If you do not need it, consider leaving your phone or computer in another room, or at home if you plan to work somewhere outside of your home. If you do need your device, consider blocking unnecessary sites with digital applications, or schedule short breaks (e.g., 5-10 minutes) approximately every hour to check for notifications on social media. Of course, everyone's attention span is different, so it is important that you find the limits of your attention for a particular task. Once you have figured out how long you can focus for on the particular activity or subject, you can break down your tasks into goals or chunks of work that you anticipate will take that long to complete.

Effective Studying. *Finding a place to work.* Where do you study most often? When you are sitting down to do your school work, consider your environment. Are you someone who needs a quiet space, or do you prefer to be around people and music? How distracted do you get by your phone and computer? Reflect on what the ideal work environment is for you, and plan to find a space that is most conducive to your own ability to focus when planning to do your coursework. You may not know what works best for you yet, and that is okay! Try out a few spaces (e.g., residence room, coffee shop, library cubicle, study rooms on campus) before making your decision.

Setting yourself up for success. Before you start a session of work, set a goal for yourself. For example, *I would like to read*

this week's chapter for Psych 100 in the next 50 minutes. Set a time commitment to your goal, minimize distractions, and be sure to schedule yourself a break so that you can rest your mind before moving on to the next task.

The skills discussed so far take practice to develop, and they may be new skills for you. Now is a great time to connect with people who are trained to teach and develop good study habits. At Queen's University, we have an entire team dedicated to helping students learn how to learn. The team is called Student Academic Success Services, or SASS for short. SASS has a number of learning and writing resources to assist you with your academics, including free 1-on-1 appointments with learning strategists for Queen's students (<https://sass.queensu.ca/>).

Strategies to Overcome Emotional Challenges

Forewarned is forearmed. Among the emotional challenges of Principles of Psychology is encountering material that could be upsetting to you. Upsetting content could be something you read in your textbook, read or watch online, or hear in lecture. Oftentimes course content that is most likely to affect us connects with some important experiences we have had, or that have happened to people we love, or both.

A deceptively simple strategy for addressing the emotional challenges of this course is looking well ahead in your syllabus. Doing so might allow you to identify, well in advance, topics that you might find difficult to learn and/or read about because of personal experiences. This approach would give you time to find out more about the content by asking your teaching assistants, instructors, or course coordinators (e.g., Undergraduate Chair in Psychology). Knowing what's coming might allow you to prepare for certain topics. For instance, you might decide to review and practice some recommended coping skills (described below) and/or recruit a friend, partner, or other source of support to attend a lecture with you. Further, you might schedule activities that you find fun or distracting

on days you know you will be encountering content you are likely to find distressing.

Although you may come across them in other courses, Principles of Psychology does not give **trigger warnings** for any course content. The reasons are both scientific and pedagogical. From a scientific standpoint, studies that have investigated the effects of trigger warnings are mixed, but the bottom line is they either have no impact or a slightly negative impact on overall student well-being. On the pedagogical side, the use of trigger warnings may lead to the avoidance of course material which impedes learning this material. Beyond course material, a more important learning opportunity also may be missed. Since trigger warnings may encourage avoidance of things that are upsetting, there are no opportunities to experience potential “triggers” and learn that you can cope, that the threat is not as bad as you thought, or that the intense emotional reaction you have does not last forever. Indeed, this principle of **exposure** to things that may be triggering or upsetting is a cornerstone of psychological treatments for post-traumatic stress disorder (PTSD) and anxiety disorders (e.g., Abramowitz, Deacon, & Whiteside, 2019; Foa, Hembree, & Rothbaum, 2007). Further, avoidance is a key mechanism that drives the persistence and worsening of many mental health symptoms (e.g., Ottenbreit, Dobson, & Quigley, 2014). For the interested reader, Box 1 presents more information about trigger warnings and further rationale for why these are not used in Principles of Psychology.

Trigger Warnings

Trigger warnings are advance notifications at the start of a video, piece of writing, or, in educational

contexts, a lecture or topic, that contains potentially distressing material. Trigger warnings involve a description of the potentially distressing content with the goal of providing the opportunity to prepare for or avoid this content. On the surface, if trigger warnings help people cope with challenging information, this might reduce negative reactions and ultimately protect mental health.

Our primary reason for not using trigger warnings is the lack of scientific evidence that they do what they are supposed to. If trigger warnings protected students from discomfort or distress, using them might have benefits that outweigh their psychological costs (see below). For instance, in a series of carefully designed experiments, Bridgland and colleagues (2019) gave some participants trigger warnings about a graphic photo and measured their levels of negative affect (e.g., adjectives like “distressed”) and anxiety before and after viewing the photo. Another group of participants did not receive any warning. In five separate studies, the groups (warned and unwarned) did not differ in their emotional reactions to graphic, upsetting content. This general effect – that trigger warnings do not impact emotional reactions to potentially upsetting content – has been replicated in studies using a graphic written passage (Bellet, Jones, & McNally, 2018) and videos (Sanson, Strange, & Garry, 2019). Sanson and colleagues (2019) summarize their series of six well designed studies as follows: “people who saw

trigger warnings, compared to people who did not, judged material to be similarly negative, experienced similarly frequent intrusive thoughts and avoidance, and comprehended subsequent material similarly well.” Ultimately, trigger warnings are not helping to reduce or offset the things that they are supposed to (e.g., distress, intrusive memories), which raises questions about their appropriateness for educational contexts.

You may be thinking that, even if they are not overtly helpful, trigger warnings can’t hurt, so why not use them? Although “hurt” may be an exaggeration, there is emerging evidence that trigger warnings may have unintended negative consequences. The initial impetus for trigger warnings came out of clinical research on post-traumatic stress disorder (PTSD). Briefly, some people with PTSD experience intense recollections (e.g., flashbacks; sensory experiences) of a traumatic event that are triggered by reminders of the trauma. Thus, it was thought warnings of these types of triggers might be helpful. However, critics of trigger warnings have long maintained that trigger warnings encourage avoidance (which fuels the persistence of symptoms and impedes learning coping strategies necessary for treatment) and increase the salience of trauma to an individual’s identity. The result is that PTSD symptoms worsen over time and people do not recover (McNally, 2014, 2016; Rosenthal et al., 2005). In line with these criticisms, studies have uncovered some of the

negative side effects of trigger warnings. First, compared to the unwarned, those who receive trigger warnings report greater negative affect and anxiety *before* viewing the potentially distressing content (Bellet et al., 2018; Bridgland et al., 2019; Gainsburg & Earl, 2018). Second, people who receive trigger warnings avoid the content more (Bridgland et al., 2019; Gainsburg & Earl, 2018); in the context of a University course, this translates to missed learning opportunities in the absence of documented benefits. Finally, trigger warnings may affect people's beliefs about their own resilience versus vulnerability. In one study, compared to unwarned participants, people who viewed trigger warnings rated themselves, and people in general, as more emotionally vulnerable following traumatic events (Bellet et al., 2018).

In balance, we think trigger warnings likely do very little to make tough content easier to consume. Further, we are concerned about the potential unintended side effects of such warnings. For those reasons, trigger warnings are not used in Principles of Psychology.

If not trigger warnings, then what?

There are ways to cope with potentially upsetting content that do not involve trigger warnings. Strategies that we recommend including:

- Looking ahead at the syllabus
- Reading keywords at the end of each chapter to see if content may be difficult

- Connecting with a member of the instructional team if there is a specific area you are concerned about

If you know you will encounter information that may be distressing, some strategies for engaging with that content include:

- Bringing a friend or family member to lecture on a day where content may be difficult
- Planning light and fun activities following what may be a difficult lecture
- Using coping and relaxation techniques, described below

Coping and Mental Hygiene. Coping means dedicating time and conscious effort to the management of your stress levels and problems that you are faced with. Stress can surface as a result of many factors, including homework, exams, work, volunteer positions, extracurricular activities, and problems in family and peer relations. When we are coping, we are utilizing techniques and engaging in activities that will help us minimize the effects of these stressors on our wellbeing.

A significant part of coping is recognizing the importance of mental hygiene. You are likely familiar with the term *hygiene*, which refers to practices we engage in that are important for maintaining our health and preventing diseases, such as showering and brushing our teeth. Mental hygiene follows the same general principle, referring to practices we engage in that are important for maintaining our mental health and

preventing psychological conditions such as burnout and mental illness.

In this module we will discuss some coping skills that you can use to facilitate mental hygiene and manage your own wellness.

Self-care. You have likely heard of the term self-care. What does it mean to you?

True self-care is not salt baths and chocolate cake, it is making the choice to build a life you don't need to regularly escape from – Brianna Wiest

Self-care tends to get a reputation in society and the media as simply being the act of taking a bubble bath or eating chocolate to reward oneself. However, self-care is actually multi-faceted, consisting of all of the activities needed to promote and maintain your health, across multiple domains. It is about developing for yourself a life that you feel you can manage, enjoy, and not need to escape from. Self-care activities are not just physical activities, but also mental, emotional, and spiritual. These activities include nutrition, sleep, hygiene, exercise, time with family and friends, as well as time alone and leisure. To engage in self-care is to deliberately choose activities that are nourishing, restorative, and that strengthen your connections with others.

One of the things that makes self-care tricky is that there are many different areas. If you're spending all your time and energy on your physical health and school, you may find you're not getting enough social time! Similarly, if you are staying up really late every night of the week to spend time with friends, the exhaustion is going to catch up with you. An important part of engaging in self-care is finding what activities are restorative for you and being sure to schedule them into your week so that your schedule is well-balanced.

Our culture tends to reward people who deal with their stress by working harder and faster to produce more in a shorter time. You might feel compelled to do this, by engaging in cramming

sessions to pump out work, and cutting out healthy habits in favour of freeing up more time to focus on studies. However, this behaviour can have a negative effect on your physical and mental health, which can result in burnout, which is a state of physical, mental and emotional collapse caused by overwork or stress.

Our bodies are equipped with something called the fight or flight system, which is activated when we are under stress. This response consists of a series of biochemical changes that prepare our bodies to deal with threat or danger. Primitive people needed rapid bursts in energy to fight or flee from predators such as saber-toothed tigers. This response can help us in threatening situations today, such as having to respond quickly to a car that cuts you off on the highway. However, not only can this system become activated when we are faced with serious dangers in our environment, but it also can activate when we are under a great deal of stress and feeling overwhelmed. Luckily, our bodies are also equipped with a relaxation response which can counter the activation of our fight/flight response.

Take a moment to consider how you relax. Some people enjoy down time, for example, reading an enjoyable book. Others might prefer scheduling time with friends, perhaps going out to dinner or seeing a movie. Some people relax through exercise or yoga. We are all different and what helps one person to relax won't necessarily be what best helps another. It is important to find out what relaxing activities help you to unwind, and to be sure to make time for these activities throughout the week to help maintain mental wellness.

The following are some techniques you can try out, which can help you to manage your stress levels and overcome emotional challenges. These techniques are drawn from evidence-based therapy protocols (e.g., Cognitive Behavioural Therapy, Beck, 1979, Beck, 2011; Dialectical Behaviour Therapy, Linehan, 2015; Acceptance and Commitment Therapy, Hayes,

Strosahl, & Wilson, 2011). These psychological therapies have been extensively researched, and are used to improve individuals' well-being across multiple mental and physical health problems.

Deep breathing. Breathing is a fundamental necessity of life that we can often take for granted. Certain breathing patterns can contribute to feelings of anxiety, panic attacks, low mood, muscle tension and fatigue. When we're anxious or stressed out, our breathing tends to become rapid and shallow. In contrast, when we are relaxed, our breathing is much deeper and slower. A technique that can help manage your stress levels, is to engage in deep breathing. This form of breathing has been found to be effective in reducing symptoms of anxiety and improving feelings of relaxation. When you recognize that you are breathing in a quick and shallow way, consciously make the choice to engage in slower breathing for a few minutes. For each breath, focus on inhaling air deep into the lungs through your nose as the abdomen expands. After holding this breath for a few moments, exhale the air out of your mouth, noticing your abdomen contracting. The process of deep breathing signals to your body that it is safe to relax and activates your relaxation response.

Progressive Muscle Relaxation. Maybe you have noticed when you are in a stressful situation or feeling overwhelmed that there is a tightening in your body. Perhaps you feel it in your shoulders, or back, or maybe you get headaches. When we are stressed, we hold tightness in our muscles and this sends signals to our brain that we are stressed out. Not only can this negatively affect how our bodies feel, but it can also influence our mood and our thoughts that we have. A good way to relax our mind, is to deliberately relax our body, taking purposeful steps to relax our muscles. Using the technique of progressive muscle relaxation, you go through each muscle group in your body, one by one, tensing the muscle groups and holding that tension for a several seconds, followed by

releasing the tension in the muscle group. This relaxing of our tension sends feedback to our brain that we are feeling calm and relaxed.

Visualization. Have you ever heard people say “go to your happy place”? This saying may be a reference to a technique called visualization. Research (e.g., Rossman, 2000) shows that focusing the imagination in a positive way can result in a state of ease, mood regulation, and can have a relaxing effect (e.g., imagining a place where you feel calm and safe). Some people do this on their own by really imagining what this place looks like, feels like, and smells like. Some people prefer to be guided to a calm place with an audio track.

Grounding. Grounding is a set of simple strategies to help detach from emotional pain, such as sadness, anger, or anxiety. When you are feeling overwhelmed with emotion, it can be helpful to find a way to detach so that you can gain control of your feelings and cope. Grounding focuses on distraction strategies that help you cope with intense emotions and anchor you to the present moment. There are several ways that you can ground yourself, and it can be done any time, any place, and anywhere. When engaging in grounding, you want to focus on the present moment, rather than ruminating about the past or worrying about the future.

Mental Grounding

- – Describe your environment in detail using all of your senses. Describe what you see in the room, hear, taste, and smell. What is the temperature? What objects do you see, and what textures do you feel? For example: *I am in the lecture hall. I see three brown walls, one in front and two to either side. I see a professor and she is pacing back and forth. The temperature is cool. I feel the armrests on my chair, and the pen in my hand.*
- – Play a categories game with yourself. Try to think of as many “types of animals”, “cars”, “TV shows”, “sports” as you

can.

- – Describe an everyday activity in great detail. For example, describing a meal that you cook (e.g., *first I boil the water, then I put salt in it, then I pour the pasta noodles in, and while that is cooking I sauté vegetables and add them to tomato sauce*)
- – Use humour. Think of something funny, like a joke or a funny clip from a TV show that you enjoyed.
- – Say a coping statement, such as *I can handle this, I will be okay, I will get through this.*

Physical Grounding

- – Grab tightly the arm rests of your chair
- – Touch objects around you for the tactile sensation, such as writing utensils, your clothing, or items in your pocket.
- – Walk slowly, noticing each footstep that you take and how your foot curves as you bring it down to meet contact with the ground.
- – Eat something and describe the flavour and texture of the bite to yourself as you hold the item of food in your mouth.

Planned exercise. Physical activity, in addition to having significant health benefit, is often recommended for emotional wellbeing as a technique for managing stress levels. Indeed, research has found that college students who exercised at least 3 days per week were less likely to report poor mental health and perceived stress than students who did not (Vankim & Nelson, 2013). Multiple studies indicate that physical activity improves mood and reduces symptoms of anxiety and depression (Rethorst et al., 2009; Rimer et al., 2012; Trivedi et al., 2011; Ross & Hayes, 1988; Stephens, 1988).

The Athletics and Recreation Centre (ARC) at Queen's University offers a wide array of fitness opportunities to

become active throughout the year, from fitness equipment, to swimming, gymnasiums, racquet courts and more (https://rec.gogaelsgo.com/sports/2013/7/26/Fac-Serv_0726133714.aspx)

Cultural, Diversity and Faith-based resources.

Culture influences our experience in many ways and can have a significant impact on our mental health, playing a role in how we relate to others, manage our emotions, and experience and express psychological distress (Roberts & Burleson, 2013). Queen's University has several resources and spaces for individuals seeking cultural and spiritual connection:

- Queen's University African and Caribbean Students Association: <https://myams.org/portfolio-items/african-and-caribbean-students-association/>

Healthy eating. Maintaining a healthy, balanced diet is not only important for physical health, but also emotional and mental health. Negative affect (e.g., anxiety, frustration, sadness, boredom, depression, fatigue, stress) has been related to food consumption in order to distract oneself from, or cope with, it. The foods consumed are often the “comfort foods” with high sugar and fats, that can provide immediate satisfaction and may even manage mood in the short term; however, leading to greater preference for indulgent foods over healthy foods (Gardner et al., 2014). Research also shows that unhealthy dietary patterns are related to poorer mental health in youth (O’Neil et al., 2014). Better overall diet quality and lower intake of simple carbohydrates and processed foods are related to lower depressive symptoms (Jacka et al., 2011; Mikolajczyk, Ansari, & Maxwell, 2009, Christensen & Somers, 1996; Quehl et al., 2017). Canada’s Food Guide 2019 (<https://food-guide.canada.ca/en/>) is a great resource that provides tips and recipes for maintaining a healthy, balanced diet.

Thirty-nine percent of Canadian post-secondary students

experience some degree of food insecurity, which ranges from worry about running out of food and having limited food selection, to missing meals, reducing food intake, or going without food for an entire day or longer due to lack of money for food. Queen's University provides the Swipe it Forward program, for short-term meal support (<https://dining.queensu.ca/swipeitforward/>). The Queen's University Student Government (AMS) offers a confidential and non-judgmental food bank service to members of the university community (<https://myams.org/team-details/food-centre/>)

Using Resources. If you find something in Principles of Psychology, or any course, to be very distressing (e.g., a discussion of mental health symptoms that you recognize in yourself) seeking help and support is also a very useful part of coping and mental hygiene. The staff (teaching assistants, course coordinator, and instructors) involved in Principles of Psychology can be good points of contact, especially for connecting you with University-based supports and accommodations (where relevant). If you are concerned about your mental health, here are some additional contacts that you might find useful:

Your family doctor

Book an appointment with your doctor. They can offer advice or refer you to other more specific services to get help. If you do not have a family doctor in Kingston or the surrounding area, Queen's University Student Wellness Services has a team of doctors and other health professionals: (<http://queensu.ca/studentwellness/health-services>).

University Counselling Service

The Counselling Service at Queen's University can help you to address personal or emotional problems that may be interfering with having a positive experience at Queen's and reaching academic and personal success. This service offers a free and confidential service. The Counselling Service is not only for those with a diagnosis. It can be contacted for any reason: (<http://queensu.ca/studentwellness/counselling-services>)

Additional Counselling Services and Information Sources

Resolve Counselling (previously k3c) in Kingston:
<https://www.resolvecounselling.org/>

Sexual Assault Centre Kingston: <http://sackington.com/>
Teens Health (information resource):
<http://www.teenshealth.org/>

Telephone Lines

*24-hour crisis line in the Kingston area:
613-544-4229*

*Kids Help Phone: 1-800-668-6868
(<https://kidshelpphone.ca/>)*

*Telephone Aid Line Kingston (TALK) line:
613-544-1771
(<http://www.telephoneaidlinekingston.com/>)*

*Good2Talk (specific for post-secondary students):
1-866-925-5454 (<https://good2talk.ca/>)*

IN AN EMERGENCY

If you are experiencing suicidal thoughts and think that you might be unable to keep yourself safe, visit Kingston General Hospital Emergency Department or call 911.

Resources for Relaxation and Coping

BREATHE 2 RELAX – Breathe2Relax includes breathing exercises to help you cope and relax

MINDSHIFT – Mindshift teaches you how to relax and cope with anxiety

VIRTUAL HOPE BOX – Virtual Hope Box helps you with coping, relaxation, distraction, and positive thinking

THINKFULL – ThinkFull teaches you to cope with stress, solve problems, and live well

FLOWY – Flowy is a game that makes breathing fun, which can help with anxiety

Websites and Free Downloads:

2. AnxietyBCYouth :<http://youth.anxietybc.com/don%E2%80%99t-tell-me-relax>
 1. Audio files for mental vacation:
<http://youth.anxietybc.com/mental-vacations>
 2. Visualization for confidence-building:
<http://youth.anxietybc.com/confidence-builders>
3. Progressive Muscle Relaxation For Management of Anxiety and Stress (Long Version WITH Music):
<https://www.youtube.com/watch?v=6053dnI4Rxg&feature=youtu.be>
4. McGill University Audio Files for Relaxation:
<https://www.mcgill.ca/counselling/getstarted/relax-meditate>
5. The benefits of exercising and how to start:
<http://youth.anxietybc.com/being-active-facts>

Resources for Time Management

EVERNOTE – Capture, organize, and share notes from anywhere (computer or phone)

2Do – Task manager that allows you to enter in your thoughts and ideas before you forget

30/30 – A task manager that allows you to set up a list of tasks, and a length of time for each of them. It uses a timer to tell you when to move on to the next task

Websites and Free Downloads

1. **Remember the milk** <https://www.rememberthemilk.com/app/#all>

An online to-do list and task manager (can be accessed by phone and computer)

2. Google Calendar <https://calendar.google.com/calendar>

Online scheduling system, allows you to set reminders for scheduled events

3. **Joe's Goals** <http://www.joesgoals.com>

Online tool to keep track of your goals

4. **Self-control** <https://selfcontrolapp.com>

Blocks access to distracting websites for a set period of time that you choose – while still allowing you access to the internet (for Macintosh computers)

5. **Freedom** <https://freedom.to>

Website blocker to improve focus and productivity.

6. **RescueTime** <https://www.rescuetime.com>

Shows you how you spend your time on your computer and provides tools to help you be more productive.

7. **The Pomodoro Technique** <https://cirillocompany.de/pages/pomodoro-technique>

Use a timer to keep yourself on track, both for your working sessions and for your breaks

Free online timer at <https://tomato-timer.com>

8. **Anki** <https://apps.ankiweb.net>

Create your own cue cards to help studying

9. **Dropbox** <https://www.dropbox.com>

Helpful for working on team projects, and keeps all your files in

one place that can be accessed from anywhere with internet (computers, phones)

10. Student Academic Success Services at Queen's University <http://sass.queensu.ca/>

Access time management templates, strategies, and tools

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52. The Healthy Life

Original chapter by Emily Hooker and Sarah Pressman adapted by the Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

Our emotions, thoughts, and behaviors play an important role in our health. Not only do they influence our day-to-day health practices, but they can also influence how our body functions. This module provides an overview of health psychology, which is a field devoted to understanding the connections between psychology and health. Discussed here are examples of topics a health psychologist might study, including stress, psychosocial factors related to health and disease, how to use psychology to improve health, and the role of psychology in medicine.

Learning Objectives

- Describe basic terminology used in the field of health psychology.
- Explain theoretical models of health, as well as the role of psychological stress in the development of disease.
- Describe psychological factors that contribute to resilience

and improved health.

- Defend the relevance and importance of psychology to the field of medicine.

What Is Health Psychology?

Today, we face more **chronic disease** than ever before because we are living longer lives while also frequently behaving in unhealthy ways. One example of a chronic disease is coronary heart disease (CHD): It is the number one cause of death worldwide (**World Health Organization, 2013**). CHD develops slowly over time and typically appears midlife, but related heart problems can persist for years after the original diagnosis or cardiovascular event. In managing illnesses that persist over time (other examples might include cancer, diabetes, and long-term disability) many psychological factors will determine the progression of the ailment. For example, do patients seek help when appropriate? Do they follow doctor recommendations? Do they develop negative psychological symptoms due to lasting illness (e.g., depression)? Also important is that psychological factors can play a significant role in *who* develops these diseases, the prognosis, and the nature of the symptoms related to the illness. Health psychology is a relatively new, interdisciplinary field of study that focuses on these very issues, or more specifically, the role of psychology in maintaining health, as well as preventing and treating illness.

Consideration of how psychological and social factors influence health is especially important today because many of the leading causes of illness in developed countries are often attributed to psychological and behavioral factors. In the case of CHD, discussed above, psychosocial factors, such as excessive stress, smoking, unhealthy eating habits, and some personality traits can also lead to increased risk of disease and worse health outcomes. That being said,



Health psychologists are helping people to adapt behaviors to avoid disease, reduce stress, and improve overall health. [Image: Adelphi Lab Center, <https://goo.gl/N9wXon>, CC BY 2.0, <https://goo.gl/BRvSA7>]

many of these factors can be adjusted using psychological techniques. For example, clinical health psychologists can improve health practices like poor dietary choices and smoking, they can teach important stress reduction techniques, and they can help treat psychological disorders tied to poor health. Health psychology considers how the choices we make, the behaviors we engage in, and even the emotions that we feel, can play an important role in our overall health (Cohen & Herbert, 1996; Taylor, 2012).

Health psychology relies on the **Biopsychosocial Model of Health**. This model posits that biology, psychology, and social factors are just as important in the development of disease as biological causes (e.g., germs, viruses), which is consistent with the World Health Organization (1946) definition of **health**. This model replaces the older **Biomedical Model of Health**, which primarily considers the physical, or pathogenic, factors contributing to illness. Thanks to advances in medical technology, there is a growing understanding of the physiology

underlying the **mind–body connection**, and in particular, the role that different feelings can have on our body’s function. Health psychology researchers working in the fields of **psychosomatic medicine** and **psychoneuroimmunology**, for example, are interested in understanding how psychological factors can “get under the skin” and influence our physiology in order to better understand how factors like stress can make us sick.

Stress And Health

You probably know exactly what it’s like to feel stress, but what you may not know is that it can objectively influence your health. Answers to questions like, “How stressed do you feel?” or “How overwhelmed do you feel?” can predict your likelihood of developing both minor illnesses as well as serious problems like future heart attack (**Cohen, Janicki-Deverts, & Miller, 2007**). (Want to measure your own stress level? Check out the links at the end of the module.) To understand how health psychologists study these types of associations, we will describe one famous example of a stress and health study. Imagine that you are a research subject for a moment. After you check into a hotel room as part of the study, the researchers ask you to report your general levels of stress. Not too surprising; however, what happens next is that you receive droplets of *cold virus* into your nose! The researchers intentionally try to make you sick by exposing you to an infectious illness. After they expose you to the virus, the researchers will then evaluate you for several days by asking you questions about your symptoms, monitoring how much mucus you are producing by weighing your used tissues, and taking body fluid samples—all to see if you are objectively ill with a cold. Now, the interesting thing is that not everyone who has drops of cold virus put in their nose develops the illness.

Studies like this one find that people who are less stressed and those who are more positive at the beginning of the study are at a decreased risk of developing a cold (**Cohen, Tyrrell, & Smith, 1991**; Cohen, Alper, Doyle, Treanor, & Turner, **2006**) (see Figure 1 for an example).

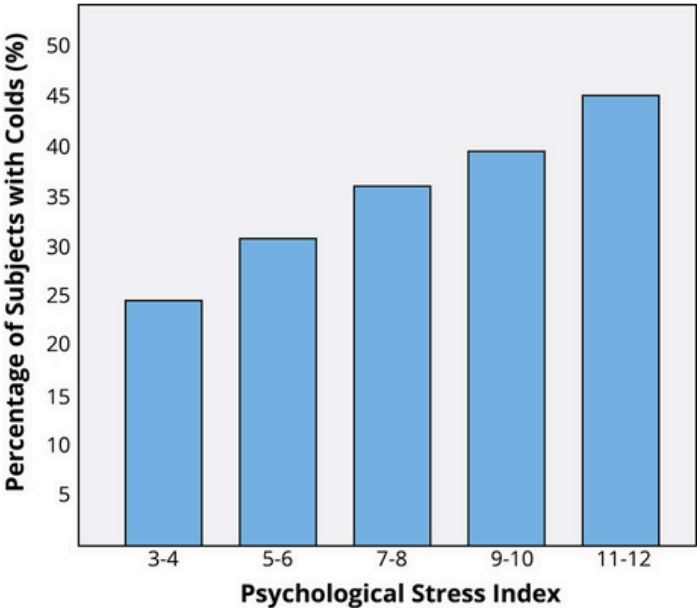


Figure 1: Adapted from Cohen et al. 1991

Importantly, it is not just major life **stressors** (e.g., a family death, a natural disaster) that increase the likelihood of getting sick. Even small **daily hassles** like getting stuck in traffic or fighting with your girlfriend can raise your blood pressure, alter your stress hormones, and even suppress your immune system function (**DeLongis, Folkman, & Lazarus, 1988**; **Twisk, Snel, Kemper, & van Machelen, 1999**).

It is clear that stress plays a major role in our mental and

physical health, but what exactly is it? The term **stress** was originally derived from the field of mechanics where it is used to describe materials under pressure. The word was first used in a *psychological* manner by researcher Hans Selye. He was examining the effect of an ovarian hormone that he thought caused sickness in a sample of rats. Surprisingly, he noticed that almost any injected hormone produced this same sickness. He smartly realized that it was not the hormone under investigation that was causing these problems, but instead, the aversive experience of being handled and injected by researchers that led to high physiological arousal and, eventually, to health problems like ulcers. Selye (1946) coined the term stressor to label a stimulus that had this effect on the body and developed a model of the stress response called the **General Adaptation Syndrome**. Since then, psychologists have studied stress in a myriad of ways, including stress as negative events (e.g., natural disasters or major life changes like dropping out of school), as chronically difficult situations (e.g., taking care of a loved one with Alzheimer's), as short-term hassles, as a biological fight-or-flight response, and even as clinical illness like post-traumatic stress disorder (PTSD). It continues to be one of the most important and well-studied psychological correlates of illness, because excessive stress causes potentially damaging wear and tear on the body and can influence almost any imaginable disease process.

Protecting Our Health

An important question that health psychologists ask is: What keeps us protected from disease and alive longer? When considering this issue of **resilience** (Rutter, 1985), five factors are often studied in terms of their ability to protect (or sometimes harm) health. They are:

1. Coping
2. Control and Self-Efficacy
3. Social Relationships
4. Dispositions and Emotions
5. Stress Management

Coping Strategies

How individuals cope with the stressors they face can have a significant impact on health. Coping is often classified into two categories: problem-focused coping or emotion-focused coping (**Carver, Scheier, & Weintraub, 1989**). **Problem-focused coping** is thought of as actively addressing the event that is causing stress in an effort to solve the issue at hand. For example, say you have an important exam coming up next week. A problem-focused strategy might be to spend additional time over the weekend studying to make sure you understand all of the material. **Emotion-focused coping**, on the other hand, regulates the emotions that come with stress. In the above examination example, this might mean watching a funny movie to take your mind off the anxiety you are feeling. In the short term, emotion-focused coping might reduce feelings of stress, but problem-focused coping seems to have the greatest impact on mental wellness (**Billings & Moos, 1981; Herman-Stabl, Stemmler, & Petersen, 1995**). That being said, when events are uncontrollable (e.g., the death of a loved one), emotion-focused coping directed at managing your feelings, at first, might be the better strategy. Therefore, it is always important to consider the match of the stressor to the coping strategy when evaluating its plausible benefits.

Control and Self-Efficacy



Feeling a sense of control in one's life is important. Something as simple as having control over the care of a houseplant has been shown to improve health and longevity. [Image: JJ Harrison, <https://goo.gl/82FsdV>, CC BY-SA 2.5, <https://goo.gl/SRAIwa>]

Another factor tied to better health outcomes and an improved ability to cope with stress is having the belief that you have **control** over a situation. For example, in one study where participants were forced to listen to unpleasant (stressful) noise, those who were led to believe that they had control over the noise performed much better on proofreading tasks afterwards (**Glass & Singer, 1972**). In other words, even

though participants *did not* have actual control over the noise, the control *belief* aided them in completing the task. In similar studies, perceived control benefited immune system functioning (**Siebert et al., 1992**). Outside of the laboratory, studies have shown that older residents in assisted living facilities, which are notorious for low control, lived *longer* and showed *better* health outcomes when given control over something as simple as watering a plant or choosing when student volunteers came to visit (**Rodin & Langer, 1977; Schulz & Hanusa, 1978**). In addition, feeling in control of a threatening situation can actually change stress hormone levels (**Dickerson & Kemeny, 2004**). Believing that you have control over your own behaviors can also have a positive influence on important outcomes like smoking cessation, contraception use, and weight management (**Wallston & Wallston, 1978**). When individuals do not believe they have control, they do not try to change. **Self-efficacy** is closely related to control, in that people

with high levels of this trait believe they can complete tasks and reach their goals. Just as feeling in control can reduce stress and improve health, higher self-efficacy can reduce stress and negative **health behaviors**, and is associated with better health (O’Leary, 1985).

Social Relationships

Research has shown that the impact of social isolation on our risk for disease and death is similar in magnitude to the risk associated with smoking regularly (Holt-Lunstad, Smith, & Layton, 2010; House, Landis, & Umberson, 1988). In fact, the importance of social relationships for our health is so significant that some scientists believe our body has developed a physiological system that encourages us to seek out our relationships, especially in times of stress (Taylor et al., 2000).

Social integration is the concept used to describe the number of social roles that you have (Cohen & Wills, 1985), as well as the lack of isolation. For example, you might be a daughter, a basketball team member, a Humane Society volunteer, a coworker, and a student. Maintaining these different roles can improve your health via encouragement from those around you to maintain a healthy lifestyle. Those in your social network might also provide you with **social support** (e.g., when you are under stress). This support might include emotional help (e.g., a hug when you need it), tangible help (e.g., lending you money), or advice. By helping to improve health behaviors and reduce stress, social relationships can have a powerful, protective impact on health, and in some cases, might even help people with serious illnesses stay alive longer (Spiegel, Kraemer, Bloom, & Gottheil, 1989).

Dispositions and Emotions: What’s Risky

and What's Protective?

Negative dispositions and personality traits have been strongly tied to an array of health risks. One of the earliest negative trait-to-health connections was discovered in the 1950s by two cardiologists. They made the interesting discovery that there were common behavioral and psychological patterns among their heart patients that were not present in other patient samples. This pattern included being competitive, impatient, hostile, and time urgent. They labeled it **Type A Behavior**. Importantly, it was found to be associated with *double* the risk of heart disease as compared with **Type B Behavior** (Friedman & Rosenman, 1959). Since the 1950s, researchers have discovered that it is the **hostility** and competitiveness components of Type A that are especially harmful to heart health (Iribarren et al., 2000; Matthews, Glass, Rosenman, & Bortner, 1977; Miller, Smith, Turner, Guijarro, & Hallet, 1996). Hostile individuals are quick to get upset, and this angry arousal can damage the arteries of the heart. In addition, given their negative personality style, hostile people often lack a health-protective supportive social network.

Positive traits and states, on the other hand, are often health protective. For example, characteristics like positive emotions (e.g., feeling happy or excited) have been tied to a wide range of benefits such as increased longevity, a reduced likelihood of developing some illnesses, and better outcomes once you are diagnosed with certain diseases (e.g., heart disease, HIV) (Pressman & Cohen, 2005). Across the world, even in the most poor and underdeveloped nations, positive emotions are consistently tied to better health (Pressman, Gallagher, & Lopez, 2013). Positive emotions can also serve as the “antidote” to stress, protecting us against some of its damaging effects (Fredrickson, 2001; Pressman & Cohen, 2005; see Figure 2). Similarly, looking on the bright side can also improve health. Optimism has been shown to improve coping, reduce stress,

and predict better disease outcomes like recovering from a heart attack more rapidly (Kubzansky, Sparrow, Vokonas, & Kawachi, 2001; Nes & Segerstrom, 2006; Scheier & Carver, 1985; Segerstrom, Taylor, Kemeny, & Fahey, 1998).

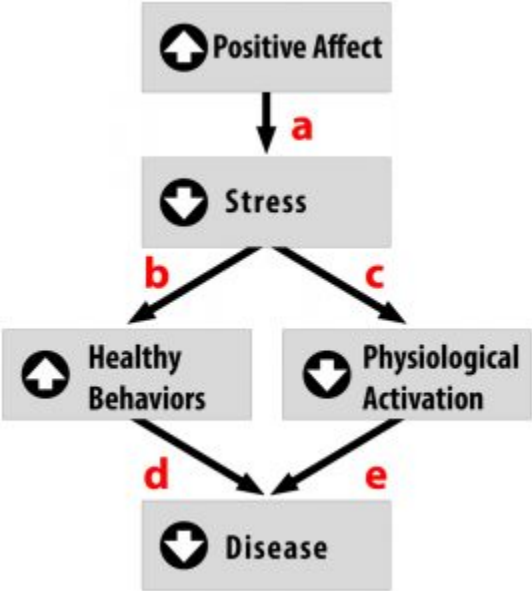


Figure 2. This figure illustrates one possible way that positive affect protects individuals against disease. Positive affect can reduce stress perceptions (a), thereby improving health behaviors (b) and lowering physiological stress responses (c) (e.g., decreased cardiovascular reactivity, lower stress hormones, non-suppressed immune activity). As a result, there is likely to be less incidence of disease (d, e). (Adapted from Pressman & Cohen, 2005)

Stress Management

About 20 percent of Americans report having stress, with 18–33 year-olds reporting the highest levels (**American Psychological**

Association, 2012). Given that the sources of our stress are often difficult to change (e.g., personal finances, current job), a number of interventions have been designed to help reduce the aversive responses to duress. For example, relaxation activities and forms of meditation are techniques that allow individuals to reduce their stress via breathing exercises, muscle relaxation, and mental imagery. Physiological arousal from stress can also be reduced via **biofeedback**, a technique where the individual is shown bodily information that is not normally available to them (e.g., heart rate), and then taught strategies to alter this signal. This type of intervention has even shown promise in reducing heart and hypertension risk, as well as other serious conditions (e.g., **Moravec, 2008; Patel, Marmot, & Terry, 1981**). But reducing stress does not have to be complicated! For example, exercise is a great stress reduction activity (**Salmon, 2001**) that has a myriad of health benefits.

The Importance Of Good Health Practices

As a student, you probably strive to maintain good grades, to have an active social life, and to stay healthy (e.g., by getting enough sleep), but there is a popular joke about what it's like to be in college: you can only pick two of these things (see Figure 3 for an example). The busy life of a college student doesn't always allow you to maintain all three areas of your life, especially during test-taking periods. In one study, researchers found that students taking exams were more stressed and, thus, smoked more, drank more caffeine, had less physical activity, and had worse sleep habits (**Oaten & Chang, 2005**), all of which could have detrimental effects on their health. Positive health practices are *especially* important in times of stress when your immune system is compromised due to high stress and the elevated frequency of exposure to the illnesses of your fellow students in lecture halls, cafeterias, and dorms.



Figure 3: A popular joke about how difficult it is to stay balanced and healthy during college.

Psychologists study both **health behaviors** and health habits. The former are behaviors that can improve or harm your health. Some examples include regular exercise, flossing, and wearing sunscreen, versus negative behaviors like drunk driving, pulling all-nighters, or smoking. These behaviors become *habits* when they are firmly established and performed automatically. For example, do you have to think about putting your seatbelt on or do you do it automatically? Habits are often developed early in life thanks to parental encouragement or the influence of our peer group.

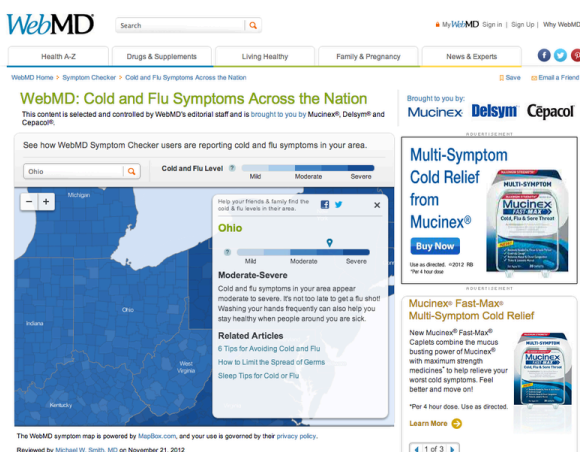
While these behaviors sound minor, studies have shown that those who engaged in more of these protective habits (e.g., getting 7–8 hours of sleep regularly, not smoking or drinking excessively, exercising) had fewer illnesses, felt better, and were less likely to die over a 9–12-year follow-up period (**Belloc & Breslow 1972; Breslow & Enstrom 1980**). For college students,

health behaviors can even influence academic performance. For example, poor sleep quality and quantity are related to weaker learning capacity and academic performance (**Curcio, Ferrara, & De Gennaro, 2006**). Due to the effects that health behaviors can have, much effort is put forward by psychologists to understand *how* to change unhealthy behaviors, and to understand *why* individuals fail to act in healthy ways. Health promotion involves enabling individuals to improve health by focusing on behaviors that pose a risk for future illness, as well as spreading knowledge on existing risk factors. These might be genetic risks you are born with, or something you developed over time like obesity, which puts you at risk for Type 2 diabetes and heart disease, among other illnesses.

Psychology And Medicine

There are many psychological factors that influence medical treatment outcomes. For example, older individuals, (**Meara, White, & Cutler, 2004**), women (**Briscoe, 1987**), and those from higher socioeconomic backgrounds (Adamson, Ben-Shlomo, Chaturvedi, & Donovan, **2008**) are all *more* likely to seek medical care. On the other hand, some individuals who need care might avoid it due to financial obstacles or preconceived notions about medical practitioners or the illness. Thanks to the growing amount of medical information online, many people now use the Internet for health information and 38% percent report that this influences their decision to see a doctor (**Fox & Jones, 2009**). Unfortunately, this is not always a good thing because individuals tend to do a poor job assessing the credibility of health information. For example, college-student participants reading online articles about HIV and syphilis rated a physician's article and a college student's article as *equally* credible if the participants said they were familiar with the health topic (**Eastin, 2001**). Credibility of health

information often means how accurate or trustworthy the information is, and it can be influenced by irrelevant factors, such as the website's design, logos, or the organization's contact information (**Freeman & Spyridakis, 2004**). Similarly, many people post health questions on online, unmoderated forums where *anyone* can respond, which allows for the possibility of inaccurate information being provided for serious medical conditions by unqualified individuals.



While the Internet has increased the amount of medical information available to the public and created greater access, there are real concerns about how people are making decisions about their health based on that information. [Image: Mapbox, <https://goo.gl/UNhmx5>, CC BY 2.0, <https://goo.gl/BRvSA7>]

After individuals decide to seek care, there is also variability in the information they give their medical provider. Poor communication (e.g., due to embarrassment or feeling rushed) can influence the accuracy of the diagnosis and the effectiveness of the prescribed treatment. Similarly, there is variation following a visit to the doctor. While most individuals are tasked with a health recommendation (e.g., buying and

using a medication appropriately, losing weight, going to another expert), not everyone *adheres* to medical recommendations (**Dunbar-Jacob & Mortimer-Stephens, 2010**). For example, many individuals take medications inappropriately (e.g., stopping early, not filling prescriptions) or fail to change their behaviors (e.g., quitting smoking). Unfortunately, getting patients to follow medical orders is not as easy as one would think. For example, in one study, over one third of diabetic patients failed to get proper medical care that would prevent or slow down diabetes-related blindness (**Schoenfeld, Greene, Wu, & Leske, 2001**)! Fortunately, as mobile technology improves, physicians now have the ability to monitor **adherence** and work to improve it (e.g., with pill bottles that monitor if they are opened at the right time). Even text messages are useful for improving treatment adherence and outcomes in depression, smoking cessation, and weight loss (**Cole-Lewis, & Kershaw, 2010**).

Being A Health Psychologist

Training as a clinical health psychologist provides a variety of possible career options. Clinical health psychologists often work on teams of physicians, social workers, allied health professionals, and religious leaders. These teams may be formed in locations like rehabilitation centers, hospitals, primary care offices, emergency care centers, or in chronic illness clinics. Work in each of these settings will pose unique challenges in patient care, but the primary responsibility will be the same. Clinical health psychologists will evaluate physical, personal, and environmental factors contributing to illness and preventing improved health. In doing so, they will then help create a treatment strategy that takes into account all dimensions of a person's life and health, which maximizes its potential for success. Those who specialize in health

psychology can also conduct research to discover new health predictors and risk factors, or develop interventions to prevent and treat illness. Researchers studying health psychology work in numerous locations, such as universities, public health departments, hospitals, and private organizations. In the related field of **behavioral medicine**, careers focus on the application of this type of research. Occupations in this area might include jobs in occupational therapy, rehabilitation, or preventative medicine. Training as a health psychologist provides a wide skill set applicable in a number of different professional settings and career paths.

The Future Of Health Psychology

Much of the past medical research literature provides an incomplete picture of human health. “Health care” is often “illness care.” That is, it focuses on the management of symptoms and illnesses as they arise. As a result, in many developed countries, we are faced with several health epidemics that are difficult and costly to treat. These include obesity, diabetes, and cardiovascular disease, to name a few. The National Institutes of Health have called for researchers to use the knowledge we have about risk factors to design effective interventions to reduce the prevalence of *preventable* illness. Additionally, there are a growing number of individuals across developed countries with *multiple* chronic illnesses and/or lasting disabilities, especially with older age. Addressing their needs and maintaining their quality of life will require skilled individuals who understand how to properly treat these populations. Health psychologists will be on the forefront of work in these areas.

With this focus on prevention, it is important that health psychologists move beyond studying risk (e.g., depression, stress, hostility, low socioeconomic status) in isolation, and

move toward studying factors that confer resilience and protection from disease. There is, fortunately, a growing interest in studying the positive factors that protect our health (e.g., **Diener & Chan, 2011**; Pressman & Cohen, **2005**; Richman, Kubzansky, Maselko, Kawachi, Choo, & Bauer, **2005**) with evidence strongly indicating that people with higher positivity live longer, suffer fewer illnesses, and generally feel better. Seligman (**2008**) has even proposed a field of “Positive Health” to specifically study those who exhibit “above average” health—something we do not think about enough. By shifting some of the research focus to identifying and understanding these health-promoting factors, we may capitalize on this information to improve public health.

Innovative interventions to improve health are already in use and continue to be studied. With recent advances in technology, we are starting to see great strides made to improve health with the aid of computational tools. For example, there are hundreds of simple applications (apps) that use email and text messages to send reminders to take medication, as well as mobile apps that allow us to monitor our exercise levels and food intake (in the growing mobile-health, or m-health, field). These m-health applications can be used to raise health awareness, support treatment and compliance, and remotely collect data on a variety of outcomes. Also exciting are devices that allow us to monitor physiology in real time; for example, to better understand the stressful situations that raise blood pressure or heart rate. With advances like these, health psychologists will be able to serve the population better, learn more about health and health behavior, and develop excellent health-improving strategies that could be specifically targeted to certain populations or individuals. These leaps in equipment development, partnered with growing health psychology knowledge and exciting advances in neuroscience and genetic research, will lead health researchers and practitioners into an exciting new time where,

hopefully, we will understand more and more about how to keep people healthy.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Adherence

In health, it is the ability of a patient to maintain a health behavior prescribed by a physician. This might include taking medication as prescribed, exercising more, or eating less high-fat food.

Behavioral medicine

A field similar to health psychology that integrates psychological factors (e.g., emotion, behavior, cognition, and social factors) in the treatment of disease. This applied field includes clinical areas of study, such as occupational therapy, hypnosis, rehabilitation or medicine, and preventative medicine.

Biofeedback

The process by which physiological signals, not normally available to human perception, are transformed into easy-to-understand graphs or numbers. Individuals can then use this information to try to change bodily functioning (e.g., lower blood pressure, reduce muscle tension).

Biomedical Model of Health

A reductionist model that posits that ill health is a result of a deviation from normal function, which is explained by the presence of pathogens, injury, or genetic abnormality.

Biopsychosocial Model of Health

An approach to studying health and human function that posits the importance of biological, psychological, and social (or environmental) processes.

Chronic disease

A health condition that persists over time, typically for periods longer than three months (e.g., HIV, asthma,

diabetes).

Control

Feeling like you have the power to change your environment or behavior if you need or want to.

Daily hassles

Irritations in daily life that are not necessarily traumatic, but that cause difficulties and repeated stress.

Emotion-focused coping

Coping strategy aimed at reducing the negative emotions associated with a stressful event.

General Adaptation Syndrome

A three-phase model of stress, which includes a mobilization of physiological resources phase, a coping phase, and an exhaustion phase (i.e., when an organism fails to cope with the stress adequately and depletes its resources).

Health

According to the World Health Organization, it is a complete state of physical, mental, and social well-being and not merely the absence of disease or infirmity.

Health behavior

Any behavior that is related to health—either good or bad.

Hostility

An experience or trait with cognitive, behavioral, and emotional components. It often includes cynical thoughts, feelings of emotion, and aggressive behavior.

Mind–body connection

The idea that our emotions and thoughts can affect how our body functions.

Problem-focused coping

A set of coping strategies aimed at improving or changing stressful situations.

Psychoneuroimmunology

A field of study examining the relationship among psychology, brain function, and immune function.

Psychosomatic medicine

An interdisciplinary field of study that focuses on how biological, psychological, and social processes contribute to physiological changes in the body and health over time.

Resilience

The ability to “bounce back” from negative situations (e.g., illness, stress) to normal functioning or to simply not show poor outcomes in the face of adversity. In some cases, resilience may lead to better functioning following the negative experience (e.g., post-traumatic growth).

Self-efficacy

The belief that one can perform adequately in a specific situation.

Social integration

The size of your social network, or number of social roles (e.g., son, sister, student, employee, team member).

Social support

The perception or actuality that we have a social network that can help us in times of need and provide us with a variety of useful resources (e.g., advice, love, money).

Stress

A pattern of physical and psychological responses in an organism after it perceives a threatening event that disturbs its homeostasis and taxes its abilities to cope with the event.

Stressor

An event or stimulus that induces feelings of stress.

Type A Behavior

Type A behavior is characterized by impatience, competitiveness, neuroticism, hostility, and anger.

Type B Behavior

Type B behavior reflects the absence of Type A characteristics and is represented by less competitive, aggressive, and hostile behavior patterns.

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53. Happiness: The Science of Subjective Well-Being

Original chapter by Edward Diener adapted by the Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen’s Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

Subjective well-being (SWB) is the scientific term for happiness and life satisfaction—thinking and feeling that your life is going well, not badly. Scientists rely primarily on self-report surveys to assess the happiness of individuals, but they have validated these scales with other types of measures. People’s levels of subjective well-being are influenced by both internal factors, such as personality and outlook, and external factors, such as the society in which they live. Some of the major determinants of subjective well-being are a person’s inborn temperament, the quality of their social relationships, the societies they live in, and their ability to meet their basic needs. To some degree people adapt to conditions so that over time our circumstances may not influence our happiness as much as one might predict they would. Importantly, researchers have also studied the outcomes of subjective well-

being and have found that “happy” people are more likely to be healthier and live longer, to have better social relationships, and to be more productive at work. In other words, people high in subjective well-being seem to be healthier and function more effectively compared to people who are chronically stressed, depressed, or angry. Thus, happiness does not just feel good, but it is good for people and for those around them.

Learning Objectives

- Describe three major forms of happiness and a cause of each of them.
- Be able to list two internal causes of subjective well-being and two external causes of subjective well-being.
- Describe the types of societies that experience the most and least happiness, and why they do.
- Describe the typical course of adaptation to events in terms of the time course of SWB.
- Describe several of the beneficial outcomes of being a happy person.
- Describe how happiness is typically measured.

Introduction

When people describe what they most want out of life, happiness is almost always on the list, and very frequently it is at the top of the list. When people describe what they want in life for their children, they frequently mention health and wealth, occasionally they mention fame or success—but they almost always mention happiness. People will claim that whether their kids are wealthy and work in some



If you had only one gift to give your child, what would it be?

Happiness? [Image: mynameisharsha, <https://goo.gl/216PFr>, CC BY-SA 3.0, <https://goo.gl/eLCn2O>]

prestigious occupation or not, “I just want my kids to be happy.” Happiness appears to be one of the most important goals for people, if not the most important. But what is it, and how do people get it? In this module I describe “**happiness**” or subjective well-being (SWB) as a process—it results from certain **internal** and **external causes**, and in turn it influences the way people behave, as well as their physiological states. Thus, high SWB is not just a pleasant outcome but is an important factor in our future success. Because scientists have developed valid ways of measuring “happiness,” they have come in the past decades to know much about its causes and consequences.

Types of Happiness

Philosophers debated the nature of happiness for thousands of years, but scientists have recently discovered that happiness means different things. Three major types of happiness are high **life satisfaction**, frequent **positive feelings**, and infrequent **negative feelings** (Diener, 1984). “**Subjective well-being**” is the label given by scientists to the various forms of happiness taken together. Although there are additional forms of SWB, the three in the table below have been studied extensively. The table also shows that the causes of the different types of happiness can be somewhat different.

Table 1: Three Types of Subjective Well-Being

Three Types of Happiness	Examples	Causes
Life Satisfaction	<ul style="list-style-type: none">• I think my life is great• I am satisfied with my job	<ul style="list-style-type: none">• A good income• Achieving one's goals• High Self-esteem
Positive Feelings	<ul style="list-style-type: none">• Enjoying life• Loving others	<ul style="list-style-type: none">• Supportive friends• Interesting work• Extroverted personality
Low Negative Feelings	<ul style="list-style-type: none">• Few chronic worries• Rarely sad or angry	<ul style="list-style-type: none">• Low neuroticism• One's goals are in harmony• A positive outlook

You can see in the table that there are different causes of happiness, and that these causes are not identical for the various types of SWB. Therefore, there is no single key, no magic wand—high SWB is achieved by combining several different important elements (**Diener & Biswas-Diener, 2008**). Thus, people who promise to know *the* key to happiness are oversimplifying.

Some people experience all three elements of happiness—they are very satisfied, enjoy life, and have only a few worries or other unpleasant emotions. Other unfortunate

people are missing all three. Most of us also know individuals who have one type of happiness but not another. For example, imagine an elderly person who is completely satisfied with her life—she has done most everything she ever wanted—but is not currently enjoying life that much because of the infirmities of age. There are others who show a different pattern, for example, who really enjoy life but also experience a lot of stress, anger, and worry. And there are those who are having fun, but who are dissatisfied and believe they are wasting their lives. Because there are several components to happiness, each with somewhat different causes, there is no magic single cure-all that creates all forms of SWB. This means that to be happy, individuals must acquire each of the different elements that cause it.

Causes of Subjective Well-Being

There are external influences on people's happiness—the circumstances in which they live. It is possible for some to be happy living in poverty with ill health, or with a child who has a serious disease, but this is difficult. In contrast, it is easier to be happy if one has supportive family and friends, ample resources to meet one's needs, and good health. But even here there are exceptions—people who are depressed and unhappy while living in excellent circumstances. Thus, people can be happy or unhappy because of their personalities and the way they think about the world or because of the external circumstances in which they live. People vary in their propensity to happiness—in their personalities and outlook—and this means that knowing their living conditions is not enough to predict happiness.

In the table below are shown internal and external circumstances that influence happiness. There are individual differences in what makes people happy, but the causes in

the table are important for most people (Diener, Suh, Lucas, & Smith, 1999; Lyubomirsky, 2013; Myers, 1992).

Internal Causes (Top-down influences)	Description
Inborn temperament	Studies of monozygotic (identical) twins raised apart indicate that our genes influence our happiness. Even when raised apart, identical twins tend to be similar in their levels of subjective well-being.
Personality and temperament	Personality is partly inborn and partly learned, and it influences our happiness. For example: Extroverts tend to have more positive feelings. Neurotics tend to have more negative feelings.
Outlook	People can develop habits of noticing the good things in life and interpreting ambiguous events in positive ways. Other people develop negative mental habits, leading to more unhappiness. One's culture also can influence whether we take an optimistic or pessimistic view of life.
Resilience	Happy individuals tend to bounce back more quickly after losses and negative events.
External Causes (Bottom-up influences)	Description
Sufficient material resources	People have enough money to meet their basic needs and fulfill their major goals.
Sufficient social resources	People differ in their need for social contact, but everyone needs some supportive and trusted others: family, a friend, or a partner, or sometimes all three. We need other people to lead a fulfilled life.
Desirable society	Our own efforts and circumstances influence our happiness, but so does the society in which we live. A society of hunger, war, conflict, and corruption is much less happy than one with material resources, high levels of trust and cooperation, and people who want to help each other.

Table 2: Internal and External Causes of Subjective Well-Being

Societal Influences on Happiness

When people consider their own happiness, they tend to think of their relationships, successes and failures, and other personal factors. But a very important influence on how happy people are is the society in which they live. It is easy to forget how important societies and neighborhoods are to people's happiness or unhappiness. In Figure 1, I present life satisfaction around the world. You can see that some nations, those with the darkest shading on the map, are high in life satisfaction. Others, the lightest shaded areas, are very low. The grey areas in the map are places we could not collect happiness data—they were just too dangerous or inaccessible.

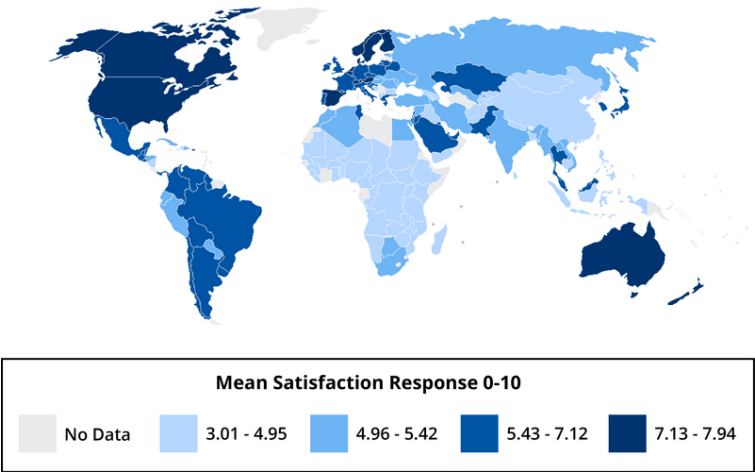


Figure 1

Can you guess what might make some societies happier than others? Much of North America and Europe have relatively high life satisfaction, and much of Africa is low in life satisfaction. For life satisfaction living in an economically developed nation is helpful because when people must

struggle to obtain food, shelter, and other basic necessities, they tend to be dissatisfied with lives. However, other factors, such as trusting and being able to count on others, are also crucial to the happiness within nations. Indeed, for enjoying life our relationships with others seem more important than living in a wealthy society. One factor that predicts unhappiness is conflict—individuals in nations with high internal conflict or conflict with neighboring nations tend to experience low SWB.

Money and Happiness

Will money make you happy? A certain level of income is needed to meet our needs, and very poor people are frequently dissatisfied with life (**Diener & Seligman, 2004**). However, having more and more money has diminishing returns—higher and higher incomes make less and less difference to happiness. Wealthy nations tend to have higher average life satisfaction than poor nations, but the United States has not experienced a rise in life satisfaction over the past decades, even as income has doubled. The goal is to find a level of income that you can live with and earn. Don't let your aspirations continue to rise so that you always feel poor, no matter how much money you have. Research shows that materialistic people often tend to be less happy, and putting your emphasis on relationships and other areas of life besides just money is a wise strategy. Money can help life satisfaction, but when too many other valuable things are sacrificed to earn a lot of money—such as relationships or taking a less enjoyable job—the pursuit of money can harm happiness.

There are stories of wealthy people who are unhappy and of janitors who are very happy. For instance, a number of extremely wealthy people in South Korea have committed suicide recently, apparently brought down by stress and other negative feelings. On the other hand, there is the hospital

janitor who loved her life because she felt that her work in keeping the hospital clean was so important for the patients and nurses. Some millionaires are dissatisfied because they want to be billionaires. Conversely, some people with ordinary incomes are quite happy because they have learned to live within their means and enjoy the less expensive things in life.

It is important to always keep in mind that high materialism seems to lower life satisfaction—valuing money over other things such as relationships can make us dissatisfied. When people think money is more important than everything else, they seem to have a harder time being happy. And unless they make a great deal of money, they are not on average as happy as others. Perhaps in seeking money they sacrifice other important things too much, such as relationships, spirituality, or following their interests. Or it may be that materialists just can never get enough money to fulfill their dreams—they always want more.

To sum up what makes for a happy life, let's take the example of Monoj, a rickshaw driver in Calcutta. He enjoys life, despite the hardships, and is reasonably satisfied with life. How could he be relatively happy despite his very low income, sometimes even insufficient to buy enough food for his family? The things that make Monoj happy are his family and friends, his religion, and his work, which he finds meaningful. His low income does lower his life satisfaction to some degree, but he finds his children to be very rewarding, and he gets along well with his neighbors. I also suspect that Monoj's positive temperament and his enjoyment of social relationships help to some degree to overcome his poverty and earn him a place among the happy. However, Monoj would also likely be even more satisfied with life if he had a higher income that allowed more food, better housing, and better medical care for his family.



Manoj, a happy rickshaw driver in Calcutta.

Besides the internal and external factors that influence happiness, there are psychological influences as well—such as our aspirations, social comparisons, and adaptation. People's aspirations are what they want in life, including income, occupation, marriage, and so forth. If people's aspirations are high,

they will often strive harder, but there is also a risk of them falling short of their aspirations and being dissatisfied. The goal is to have challenging aspirations but also to be able to adapt to what actually happens in life.

One's outlook and resilience are also always very important to happiness. Every person will have disappointments in life, fail at times, and have problems. Thus, happiness comes not to people who never have problems—there are no such individuals—but to people who are able to bounce back from failures and adapt to disappointments. This is why happiness is never caused just by what happens to us but always includes our outlook on life.

Adaptation to Circumstances

The process of **adaptation** is important in understanding happiness. When good and bad events occur, people often react strongly at first, but then their reactions adapt over time and they return to their former levels of happiness. For instance, many people are euphoric when they first marry, but over time they grow accustomed to the marriage and are no

longer ecstatic. The marriage becomes commonplace and they return to their former level of happiness. Few of us think this will happen to us, but the truth is that it usually does. Some people will be a bit happier even years after marriage, but nobody carries that initial “high” through the years.

People also adapt over time to bad events. However, people take a long time to adapt to certain negative events such as unemployment. People become unhappy when they lose their work, but over time they recover to some extent. But even after a number of years, unemployed individuals sometimes have lower life satisfaction, indicating that they have not completely habituated to the experience. However, there are strong individual differences in adaptation, too. Some people are resilient and bounce back quickly after a bad event, and others are fragile and do not ever fully adapt to the bad event. Do you adapt quickly to bad events and bounce back, or do you continue to dwell on a bad event and let it keep you down?

An example of adaptation to circumstances is shown in Figure 3, which shows the daily moods of “Harry,” a college student who had Hodgkin’s lymphoma (a form of cancer). As can be seen, over the 6-week period when I studied Harry’s moods, they went up and down. A few times his moods dropped into the negative zone below the horizontal blue line. Most of the time Harry’s moods were in the positive zone above the line. But about halfway through the study Harry was told that his cancer was in remission—effectively cured—and his moods on that day spiked way up. But notice that he quickly adapted—the effects of the good news wore off, and Harry adapted back toward where he was before. So even the very best news one can imagine—recovering from cancer—was not enough to give Harry a permanent “high.” Notice too, however, that Harry’s moods averaged a bit higher after cancer remission. Thus, the typical pattern is a strong response to the event, and then a dampening of this joy over time. However,

even in the long run, the person might be a bit happier or unhappier than before.

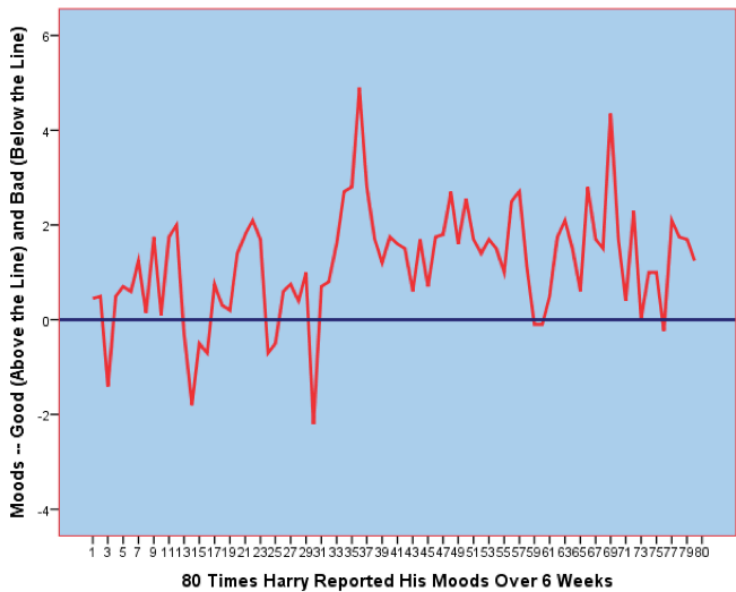


Figure 3. Harry's Daily Moods

Outcomes of High Subjective Well-Being

Is the state of happiness truly a good thing? Is happiness simply a feel-good state that leaves us unmotivated and ignorant of the world's problems? Should people strive to be happy, or are they better off to be grumpy but "realistic"? Some have argued that happiness is actually a bad thing, leaving us superficial and uncaring. Most of the evidence so far suggests that happy people are healthier, more sociable, more productive, and better citizens (Diener & Tay, 2012; Lyubomirsky, King, & Diener, 2005). Research shows that the

happiest individuals are usually very sociable. The table below summarizes some of the major findings.

Positive Outcomes	Description of Some of the Benefits
Health and Longevity	Happy and optimistic people have stronger immune systems and fewer cardiovascular diseases. Happy people are more likely to perform healthy behaviors, such as wearing seat belts and adhere to medical regimens. They also seem on average to live longer.
Social Relationships	Happy people are more popular, and their relationships are more stable and rewarding. For example, they get divorced less and are fired from work less. They support others more, and receive more support from others in return.
Productivity	Organizations in which people are positive and satisfied seem to be more successful. Work units with greater subjective well-being are more productive, and companies with happy workers tend to earn more money and develop higher stock prices.
Citizenship	Happy people are more likely to donate their time and money to charitable causes and to help others at work.

Table 3: Benefits of Happiness

Although it is beneficial generally to be happy, this does not mean that people should be constantly euphoric. In fact, it is appropriate and helpful sometimes to be sad or to worry. At times a bit of worry mixed with positive feelings makes people more creative. Most successful people in the workplace seem to be those who are mostly positive but sometimes a bit negative. Thus, people need not be a superstar in happiness to be a superstar in life. What is not helpful is to be chronically unhappy. The important question is whether people are satisfied with how happy they are. If you feel mostly positive and satisfied, and yet occasionally worry and feel stressed, this is probably fine as long as you feel comfortable with this level of happiness. If you are a person who is chronically unhappy much of the time, changes are needed, and perhaps professional intervention would help as well.

Measuring Happiness

SWB researchers have relied primarily on **self-report scales** to assess happiness—how people rate their own happiness levels on self-report surveys. People respond to numbered scales to indicate their levels of satisfaction, positive feelings, and lack of negative feelings. You can see where you stand on these scales by going to <http://labs.psychology.illinois.edu/~ediener/FS.html> or by filling out the Flourishing Scale below. These measures will give you an idea of what popular scales of happiness are like.

Below are eight statements with which you may agree or disagree. Using the 1–7 scale, indicate your agreement with each item by picking the appropriate response for each statement.

7 – Strongly agree

6 – Agree

5 – Slightly agree

4 – Neither agree nor disagree

3 – Slightly disagree

2 – Disagree

1 – Strongly disagree

☐ I lead a purposeful and meaningful life

☐ My social relationships are supportive and rewarding

☐ I am engaged and interested in my daily activities

☐ I actively contribute to the happiness and well-being of others

☐ I am competent and capable in the activities that are important to me

☐ I am a good person and live a good life

☐ I am optimistic about my future

☐ People respect me

Scoring:

Add the responses, varying from 1 to 7, for all eight items. The possible range of scores is from 8 (lowest possible) to 56 (highest PWB possible). A high score represents a person with many psychological resources and strengths.

The Flourishing Scale

The self-report scales have proved to be relatively valid (**Diener, Inglehart, & Tay, 2012**), although people can lie, or fool themselves, or be influenced by their current moods or situational factors. Because the scales are imperfect, well-being

scientists also sometimes use biological measures of happiness (e.g., the strength of a person's immune system, or measuring various brain areas that are associated with greater happiness). Scientists also use reports by family, coworkers, and friends—these people reporting how happy they believe the target person is. Other measures are used as well to help overcome some of the shortcomings of the self-report scales, but most of the field is based on people telling us how happy they are using numbered scales.

There are scales to measure life satisfaction (**Pavot & Diener, 2008**), positive and negative feelings, and whether a person is psychologically flourishing (**Diener et al., 2009**). Flourishing has to do with whether a person feels meaning in life, has close relationships, and feels a sense of mastery over important life activities. You can take the well-being scales created in the Diener laboratory, and let others take them too, because they are free and open for use.

Some Ways to Be Happier

Most people are fairly happy, but many of them also wish they could be a bit more satisfied and enjoy life more. Prescriptions about how to achieve more happiness are often oversimplified because happiness has different components and prescriptions need to be aimed at where each individual needs improvement—one size does not fit all. A person might be strong in one area and deficient in other areas. People with prolonged serious unhappiness might need help from a professional. Thus, recommendations for how to achieve happiness are often appropriate for one person but not for others. With this in mind, I list in Table 4 below some general recommendations for you to be happier (see also **Lyubomirsky, 2013**):

Self-Questions for Becoming Happier
Are there controllable things in your life that could be changed to make your life more meaningful and happy? What are the avenues to change and why haven't you taken them?
Do you generally see the bright side of things - the part of the glass that is half full, or do you always see the dark side of things? Can you change this outlook on life by working to break the empty-glass view of life? Can you develop more positive mental habits, such as being grateful to others for all of the things they do for you?
Are there people around you who make you feel good about yourself and who make your life more enjoyable? How can you reduce the number of “downers” who might surround you?
In your relationships, seek to make others happy and help others, not just receive support from others. The happiest and healthiest people are often those who help others and the world. Beyond actually helping others, express gratefulness to them and be a person who gives lots of compliments.
Find work that you will love and be good at, while being realistic about your chances of finding certain jobs. Don't over-weigh the importance of money or status in selecting an occupation. Find a job that interests you and plays to your strengths. If you find a job you love, this can be a big boost to happiness.

Table 4: Self-Examination

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Adaptation

The fact that after people first react to good or bad events, sometimes in a strong way, their feelings and reactions tend to dampen down over time and they return toward their original level of subjective well-being.

“Bottom-up” or external causes of happiness

Situational factors outside the person that influence his or her subjective well-being, such as good and bad events and circumstances such as health and wealth.

Happiness

The popular word for subjective well-being. Scientists sometimes avoid using this term because it can refer to different things, such as feeling good, being satisfied, or even the causes of high subjective well-being.

Life satisfaction

A person reflects on their life and judges to what degree it is going well, by whatever standards that person thinks are most important for a good life.

Negative feelings

Undesirable and unpleasant feelings that people tend to avoid if they can. Moods and emotions such as depression, anger, and worry are examples.

Positive feelings

Desirable and pleasant feelings. Moods and emotions such as enjoyment and love are examples.

Subjective well-being

The name that scientists give to happiness—thinking and feeling that our lives are going very well.

Subjective well-being scales

Self-report surveys or questionnaires in which participants indicate their levels of subjective well-being, by responding to items with a number that indicates how well off they feel.

“Top-down” or internal causes of happiness

The person’s outlook and habitual response tendencies that influence their happiness—for example, their

temperament or optimistic outlook on life.

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PSYC 100 XIX

PSYCHOPATHOLOGY I

54. Anxiety and Related Disorders

Original chapter by David Barlow and
Kristen K. Ellard adapted by the Queen's
University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

Anxiety is a natural part of life and, at normal levels, helps us to function at our best. However, for people with anxiety disorders, anxiety is overwhelming and hard to control. Anxiety disorders develop out of a blend of biological (genetic) and psychological factors that, when combined with stress, may lead to the development of ailments. Primary anxiety-related diagnoses include generalized anxiety disorder, panic disorder, specific phobia, social anxiety disorder (social phobia), post traumatic stress disorder, and obsessive-compulsive disorder. In this module, we summarize the main clinical features of each of these disorders and discuss their similarities and differences with everyday experiences of anxiety.

Learning Objectives

- Understand the relationship between anxiety and anxiety disorders.
- Identify key vulnerabilities for developing anxiety and related disorders.
- Identify main diagnostic features of specific anxiety-related disorders.
- Differentiate between disordered and non-disordered functioning.

Introduction

What is anxiety? Most of us feel some anxiety almost every day of our lives. Maybe you have an important test coming up for school. Or maybe there's that big game next Saturday, or that first date with someone new you are hoping to impress. **Anxiety** can be defined as a negative mood state that is accompanied by bodily symptoms such as increased heart rate, muscle tension, a sense of unease, and apprehension about the future (APA, 2013; Barlow, 2002).

Anxiety is what motivates us to plan for the future, and in this sense, anxiety is actually a good thing. It's that nagging feeling that motivates us to study for that test, practice harder for that game, or be at our very best on that date. But some people experience anxiety so intensely that it is no longer helpful or useful. They may become so overwhelmed and distracted by anxiety that they actually fail their test, fumble the ball, or spend the whole date fidgeting and avoiding eye contact. If anxiety begins to interfere in the person's life in a significant way, it is considered a disorder. Anxiety and closely related disorders emerge from "triple vulnerabilities," a combination of

biological, psychological, and specific factors that increase our risk for developing a disorder (Barlow, 2002; Suárez, Bennett, Goldstein, & Barlow, 2009). **Biological vulnerabilities** refer to specific genetic and neurobiological factors that might predispose someone to develop anxiety disorders. No single gene directly causes anxiety or panic, but our genes may make us more susceptible to anxiety and influence how our brains react to stress (Drabant et al., 2012; Gelernter & Stein, 2009; Smoller, Block, & Young,



While everyone may experience some level of anxiety at one time or another, those with anxiety disorders experience it consistently and so intensely that it has a significantly negative impact on their quality of life. [Image: Bada Bing, <https://goo.gl/aawyLi>, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

2009). **Psychological vulnerabilities** refer to the influences that our early experiences have on how we view the world. If we were confronted with unpredictable stressors or traumatic experiences at younger ages, we may come to view the world as unpredictable and uncontrollable, even dangerous (Chorpita & Barlow, 1998; Gunnar & Fisher, 2006). **Specific vulnerabilities** refer to how our experiences lead us to focus and channel our anxiety (Suárez et al., 2009). If we learned that physical illness is dangerous, maybe through witnessing our family's reaction whenever anyone got sick, we may focus our anxiety on physical sensations. If we learned that disapproval from others has negative, even dangerous consequences, such as being yelled at or severely punished for even the slightest offense, we might focus our anxiety on social evaluation. If we learn that the "other shoe might drop" at any moment, we may focus our anxiety on worries about the future. None of these

vulnerabilities directly causes anxiety disorders on its own—instead, when all of these vulnerabilities are present, and we experience some triggering life stress, an anxiety disorder may be the result (**Barlow, 2002**; Suárez et al., **2009**). In the next sections, we will briefly explore each of the major anxiety based disorders, found in the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5) (**APA, 2013**).

Generalized Anxiety Disorder

Most of us worry some of the time, and this worry can actually be useful in helping us to plan for the future or make sure we remember to do something important. Most of us can set aside our worries when we need to focus on other things or stop worrying altogether whenever a problem has passed. However, for someone with **generalized anxiety disorder (GAD)**, these worries become difficult, or even impossible, to turn off. They may find themselves worrying excessively about a number of different things, both minor and catastrophic. Their worries also come with a host of other symptoms such as muscle tension, fatigue, agitation or restlessness, irritability, difficulties with sleep (either falling asleep, staying asleep, or both), or difficulty concentrating. The *DSM-5* criteria specify that at least six months of excessive anxiety and worry of this type must be ongoing, happening more days than not for a good proportion of the day, to receive a diagnosis of GAD. About 5.7% of the population has met criteria for GAD at some point during their lifetime (**Kessler, Berglund, et al., 2005**), making it one of the most common anxiety disorders (see Table 1).

Disorder	1-Year Prevalence Rates ¹	Lifetime Prevalence Rates ²	Prevalence by Gender	Median Age of Onset
Generalized Anxiety Disorder	3.1%	5.7%	67% female	31 yrs.
OCD	1%	1.6%	55% female	19 yrs.
Panic Disorder	2.7%	4.7%	67% female	24 yrs.
PTSD	3.5%	6.8%	52% female ³	23 yrs.
Social Anxiety	6.8%	12.1%	50% female	13 yrs.
Specific Phobia	8.7%	12.5%	60% - 90% female ⁴	7-9 yrs.

Table 1: Prevalence rates for major anxiety disorders. [1] Kessler et al. (2005), [2]Kessler, Chiu, Demler, Merikangas, & Walters (2005), [3]Kessler, Sonnega, Bromet, Hughes, & Nelson (1995), [4]Craske et al. (1996).

What makes a person with GAD worry more than the average person? Research shows that individuals with GAD are more sensitive and vigilant toward possible threats than people who are not anxious (Aikins & Craske, **2001**; Barlow, **2002**; Bradley, Mogg, White, Groom, & de Bono, **1999**). This may be related to early stressful experiences, which can lead to a view of the world as an unpredictable, uncontrollable, and even dangerous place. Some have suggested that people with GAD worry as a way to gain some control over these otherwise uncontrollable or unpredictable experiences and against uncertain outcomes (**Dugas, Gagnon, Ladouceur, & Freeston, 1998**). By repeatedly going through all of the possible “What if?” scenarios in their mind, the person might feel like they are less vulnerable to an unexpected outcome, giving them the sense that they have some control over the situation (**Wells, 2002**). Others have suggested people with GAD worry as a way to avoid feeling distressed (**Borkovec, Alcaine, & Behar, 2004**). For example, **Borkovec and Hu (1990)** found that those who worried when confronted with a stressful situation had less physiological arousal than those who didn’t worry, maybe because the worry “distracted” them in some way.

The problem is, all of this “what if?”-ing doesn’t get the person any closer to a solution or an answer and, in fact, might take them away from important things they should be paying attention to in the moment, such as finishing an important project. Many of the catastrophic outcomes people with GAD worry about are very unlikely to happen, so when the catastrophic event doesn’t materialize, the act of worrying gets **reinforced (Borkovec, Hazlett-Stevens, & Diaz, 1999)**. For example, if a mother spends all night worrying about whether her teenage daughter will get home safe from a night out and the daughter returns home without incident, the mother could easily attribute her daughter’s safe return to her successful “vigil.” What the mother hasn’t learned is that her daughter would have returned home just as safe if she had been focusing on the movie she was watching with her husband, rather than being preoccupied with worries. In this way, the cycle of worry is perpetuated, and, subsequently, people with GAD often miss out on many otherwise enjoyable events in their lives.

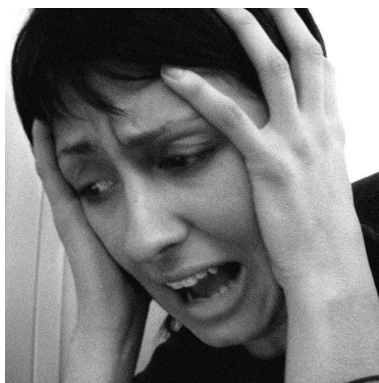
Panic Disorder and Agoraphobia

Have you ever gotten into a near-accident or been taken by surprise in some way? You may have felt a flood of physical sensations, such as a racing heart, shortness of breath, or tingling sensations. This alarm reaction is called the **“fight or flight”** response (**Cannon, 1929**) and is your body’s natural reaction to fear, preparing you to either fight or escape in response to threat or danger. It’s likely you weren’t too concerned with these sensations, because you knew what was causing them. But imagine if this alarm reaction came “out of the blue,” for no apparent reason, or in a situation in which you didn’t expect to be anxious or fearful. This is called an “unexpected” panic attack or a false alarm. Because there is no

apparent reason or cue for the alarm reaction, you might react to the sensations with intense fear, maybe thinking you are having a heart attack, or going crazy, or even dying. You might begin to associate the physical sensations you felt during this attack with this fear and may start to go out of your way to avoid having those sensations again.

Unexpected panic attacks such as these are at the heart of **panic disorder (PD)**.

However, to receive a diagnosis of PD, the person must not only have unexpected panic attacks but also must experience continued intense anxiety and avoidance related to the attack for at least one month, causing significant distress or interference in their lives. People with panic disorder tend to interpret even normal physical sensations in a catastrophic way, which triggers more anxiety and, ironically, more physical



Panic disorder is a debilitating condition that leaves sufferers with acute anxiety that persists long after a specific panic attack has subsided. When this anxiety leads to deliberate avoidance of particular places and situations a person may be given a diagnosis of agoraphobia. [Image: Nate Steiner, <https://goo.gl/dUYWDF>, Public Domain]

sensations, creating a vicious cycle of panic (Clark, 1986, 1996). The person may begin to avoid a number of situations or activities that produce the same physiological arousal that was present during the beginnings of a panic attack. For example, someone who experienced a racing heart during a panic attack might avoid exercise or caffeine. Someone who experienced choking sensations might avoid wearing high-necked sweaters or necklaces. Avoidance of these **internal bodily or somatic cues** for panic has been termed **interoceptive avoidance**

(Barlow & Craske, **2007**; Brown, White, & Barlow, **2005**; Craske & Barlow, **2008**; Shear et al., **1997**).

The individual may also have experienced an overwhelming urge to escape during the unexpected panic attack. This can lead to a sense that certain places or situations—particularly situations where escape might not be possible—are not “safe.” These situations become **external cues** for panic. If the person begins to avoid several places or situations, or still endures these situations but does so with a significant amount of apprehension and anxiety, then the person also has **agoraphobia** (Barlow, **2002**; Craske & Barlow, **1988**; Craske & Barlow, **2008**). Agoraphobia can cause significant disruption to a person’s life, causing them to go out of their way to avoid situations, such as adding hours to a commute to avoid taking the train or only ordering take-out to avoid having to enter a grocery store. In one tragic case seen by our clinic, a woman suffering from agoraphobia had not left her apartment for 20 years and had spent the past 10 years confined to one small area of her apartment, away from the view of the outside. In some cases, agoraphobia develops in the absence of panic attacks and therefor is a separate disorder in DSM-5. But agoraphobia often accompanies panic disorder.

About 4.7% of the population has met criteria for PD or agoraphobia over their lifetime (Kessler, Chiu, Demler, Merikangas, & Walters, **2005**; **Kessler et al., 2006**) (see Table 1). In all of these cases of panic disorder, what was once an adaptive natural alarm reaction now becomes a learned, and much feared, false alarm.

Specific Phobia

The majority of us might have certain things we fear, such as bees, or needles, or heights (**Myers et al., 1984**). But what if this fear is so consuming that you can’t go out on a summer’s

day, or get vaccines needed to go on a special trip, or visit your doctor in her new office on the 26th floor? To meet criteria for a diagnosis of specific phobia, there must be an irrational fear of a specific object or situation that substantially interferes with the person's ability to function. For example, a patient at our clinic turned down a prestigious and coveted artist residency because it required spending time near a wooded area, bound to have insects. Another patient purposely left her house two hours early each morning so she could walk past her neighbor's fenced yard before they let their dog out in the morning.

The list of possible phobias is staggering, but four major subtypes of specific phobia are recognized: blood-injury-injection (BII) type, situational type (such as planes, elevators, or enclosed places), natural environment type for events one may encounter in nature (for example, heights, storms, and water), and animal type.



Elevators can be a trigger for sufferers of claustrophobia or agoraphobia. [Image: srgpicker, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

A fifth category “other” includes phobias that do not fit any of the four major subtypes (for example, fears of choking, vomiting, or contracting an illness). Most phobic reactions cause a surge of activity in the sympathetic nervous system and increased heart rate and blood pressure, maybe even a panic attack. However, people with BII type phobias

usually experience a marked *drop* in heart rate and blood pressure and may even faint. In this way, those with BII phobias almost always differ in their physiological reaction from people with other types of phobia (Barlow & Liebowitz, 1995; Craske, Antony, & Barlow, 2006; Hofmann, Alpers, & Pauli, 2009; Ost,

1992). BII phobia also runs in families more strongly than any phobic disorder we know (Antony & Barlow, 2002; Page & Martin, 1998). Specific phobia is one of the most common psychological disorders in the United States, with 12.5% of the population reporting a lifetime history of fears significant enough to be considered a “phobia” (Arrindell et al., 2003; Kessler, Berglund, et al., 2005) (see Table 1). Most people who suffer from specific phobia tend to have multiple phobias of several types (Hofmann, Lehman, & Barlow, 1997

Social Anxiety Disorder (Social Phobia)

Many people consider themselves shy, and most people find social evaluation uncomfortable at best, or giving a speech somewhat mortifying. Yet, only a small proportion of the population fear these types of situations significantly enough to merit a diagnosis of **social anxiety disorder (SAD)** (APA, 2013). SAD is more than exaggerated shyness (Bogels et al., 2010; Schneier et al., 1996). To receive a diagnosis of SAD, the fear and anxiety associated with social situations must be so strong that the person avoids them entirely, or if avoidance is not possible, the person endures them with a great deal of distress. Further, the fear and avoidance of social situations must get in the way of the person’s daily life, or seriously limit their academic or occupational functioning. For example, a patient at our clinic compromised her perfect 4.0 grade point average because she could not complete a required oral presentation in one of her classes, causing her to fail the course. Fears of negative evaluation might make someone repeatedly turn down invitations to social events or avoid having conversations with people, leading to greater and greater isolation.

The specific social situations that trigger anxiety and fear range from one-on-one interactions, such as starting or

maintaining a conversation; to performance-based situations, such as giving a speech or performing on stage; to assertiveness, such as asking someone to change disruptive or undesirable behaviors. Fear of social evaluation might even extend to such things as using public restrooms, eating in a restaurant, filling out forms in a public place, or even reading on a train. Any type of situation that could potentially draw attention to the person can become a feared social situation. For example, one patient of ours went out of her way to avoid any situation in which she might have to use a public restroom for fear that someone would hear her in the bathroom stall and think she was disgusting. If the fear is limited to performance-based situations, such as public speaking, a diagnosis of **SAD performance only** is assigned.

What causes someone to fear social situations to such a large extent? The person may have learned growing up that social evaluation in particular can be dangerous, creating a specific psychological vulnerability to develop social anxiety (**Bruch & Heimberg, 1994; Lieb et al., 2000; Rapee & Melville, 1997**). For example, the person's caregivers may have harshly criticized and punished them for even the smallest mistake, maybe even punishing them physically.

Or, someone might have experienced a social trauma that had lasting effects, such as being bullied or humiliated. Interestingly, one group of researchers found that 92% of adults in their study sample with social phobia experienced severe teasing and bullying in childhood, compared with only 35% to 50% among people with other anxiety disorders (McCabe, Antony, Summerfeldt, Liss, &



Social trauma in childhood may have long-lasting effects. [Image: ihtatho, <https://goo.gl/dTzrdj>, CC BY-NC 2.0, <https://goo.gl/VnKIK8>]

Swinson, **2003**). Someone else might react so strongly to the anxiety provoked by a social situation that they have an unexpected panic attack. This panic attack then becomes associated (**conditioned response**) with the social situation, causing the person to fear they will panic the next time they are in that situation. This is not considered PD, however, because the person's fear is more focused on social evaluation than having unexpected panic attacks, and the fear of having an attack is limited to social situations. As many as 12.1% of the general population suffer from social phobia at some point in their lives (**Kessler, Berglund, et al., 2005**), making it one of the most common anxiety disorders, second only to specific phobia (see Table 1).

Posttraumatic Stress Disorder

With stories of war, natural disasters, and physical and sexual assault dominating the news, it is clear that trauma is a reality for many people. Many individual traumas that occur every

day never even make the headlines, such as a car accident, domestic abuse, or the death of a loved one. Yet, while many people face traumatic events, not everyone who faces a trauma develops a disorder. Some, with the help of family and friends, are able to recover and continue on with their lives (**Friedman, 2009**). For some, however, the months and years following a trauma are filled with intrusive reminders of the event, a sense of intense fear that another traumatic event might occur, or a sense of isolation and emotional numbing. They may engage in a host of behaviors intended to protect themselves from being vulnerable or unsafe, such as constantly scanning their surroundings to look for signs of potential danger, never sitting with their back to the door, or never allowing themselves to be anywhere alone. This lasting reaction to trauma is what characterizes **posttraumatic stress disorder (PTSD)**.

A diagnosis of PTSD begins with the traumatic event itself. An individual must have been exposed to an event that involves actual or threatened death, serious injury, or sexual violence. To receive a diagnosis of PTSD, exposure to the event must include either directly experiencing the event, witnessing the event happening to someone else, learning that the event occurred to a close relative or friend, or having repeated or extreme exposure to details of the event (such as in the case of first responders). The person subsequently re-experiences the event through both intrusive memories and nightmares. Some memories may come back so vividly that the person feels like they are experiencing the event all over again, what is known as having a **flashback**. The individual may avoid anything that reminds them of the trauma, including conversations, places, or even specific types of people. They may feel emotionally numb or restricted in their ability to feel, which may interfere in their interpersonal relationships. The person may not be able to remember certain aspects of what happened during the event. They may feel a sense of a foreshortened future, that they will never marry, have a family, or live a long, full life. They may

be jumpy or easily startled, hypervigilant to their surroundings, and quick to anger. The prevalence of PTSD among the population as a whole is relatively low, with 6.8% having experienced PTSD at some point in their life (**Kessler, Berglund, et al., 2005**) (see Table 1). Combat and sexual assault are the most common precipitating traumas (**Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995**). Whereas PTSD was previously categorized as an Anxiety Disorder, in the most recent version of the DSM (DSM-5; **APA, 2013**) it has been reclassified under the more specific category of Trauma- and Stressor-Related Disorders.

A person with PTSD is particularly sensitive to both internal and external cues that serve as reminders of their traumatic experience. For example, as we saw in PD, the physical sensations of arousal present during the initial trauma can become threatening in and of themselves, becoming a powerful reminder of the event. Someone might avoid watching intense or emotional movies in order to prevent the experience of emotional arousal. Avoidance of conversations, reminders, or even of the experience of emotion itself may also be an attempt to avoid triggering internal cues. External stimuli that were present during the trauma can also become strong triggers. For example, if a woman is raped by a man wearing a red t-shirt, she may develop a strong alarm reaction to the sight of red shirts, or perhaps even more indiscriminately to anything with a similar color red. A combat veteran who experienced a strong smell of gasoline during a roadside bomb attack may have an intense alarm reaction when pumping gas back at home. Individuals with a psychological vulnerability toward viewing the world as uncontrollable and unpredictable may particularly struggle with the possibility of additional future, unpredictable traumatic events, fueling their need for hypervigilance and avoidance, and perpetuating the symptoms of PTSD.

Obsessive-Compulsive Disorder

Have you ever had a strange thought pop into your mind, such as picturing the stranger next to you naked? Or maybe you walked past a crooked picture on the wall and couldn't resist straightening it. Most people have occasional strange thoughts and may even engage in some "compulsive" behaviors, especially when they are stressed (Boyer & Liénard, 2008; Fullana et al., 2009). But for most people, these thoughts are nothing more than a passing oddity, and the behaviors are done (or not done) without a second thought. For someone with **obsessive-compulsive disorder (OCD)**, however, these thoughts and compulsive behaviors don't just come and go. Instead, strange or unusual thoughts are taken to mean something much more important and real, maybe even something dangerous or frightening. The urge to engage in some behavior, such as straightening a picture, can become so intense that it is nearly impossible *not* to carry it out, or causes significant anxiety if it can't be carried out. Further, someone with OCD might become preoccupied with the possibility that the behavior wasn't carried out to completion and feel compelled to repeat the behavior again and again, maybe several times before they are "satisfied."

To receive a diagnosis of OCD, a person must experience obsessive thoughts and/or compulsions that seem irrational or nonsensical, but that keep coming into their mind. Some examples of obsessions include doubting thoughts (such as doubting a door is locked or an appliance is turned off), thoughts of contamination (such as thinking that touching almost anything might give you cancer), or



People suffering from OCD may have an irrational fear of germs and “becoming contaminated”.
[Image: benchilada, <https://goo.gl/qemgDm>, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

aggressive thoughts or images that are unprovoked or nonsensical. Compulsions may be carried out in an attempt to neutralize some of these thoughts, providing temporary relief from the anxiety the obsessions cause, or they may be nonsensical in and of themselves. Either way, compulsions are distinct in that they must be repetitive or excessive, the person feels “driven” to carry out the behavior, and the person feels a great deal of distress if they can’t engage in the behavior. Some examples of compulsive behaviors are repetitive washing (often in response to contamination obsessions), repetitive checking (locks, door handles, appliances often in response to doubting obsessions), ordering and arranging things to ensure symmetry, or doing things according to a specific ritual or sequence (such as getting dressed or ready for bed in a specific order). To meet diagnostic criteria for OCD, engaging in obsessions and/or compulsions must take up a significant amount of the person’s time, at least an hour per day, and must cause significant distress or impairment in functioning. About 1.6% of the population has met criteria for OCD over the course

of a lifetime (**Kessler, Berglund, et al., 2005**) (see Table 1). Whereas OCD was previously categorized as an Anxiety Disorder, in the most recent version of the DSM (DSM-5; **APA, 2013**) it has been reclassified under the more specific category of Obsessive-Compulsive and Related Disorders.

People with OCD often confuse having an intrusive thought with their potential for carrying out the thought. Whereas most people when they have a strange or frightening thought are able to let it go, a person with OCD may become “stuck” on the thought and be intensely afraid that they might somehow lose control and act on it. Or worse, they believe that having the thought is just as bad as doing it. This is called **thought-action fusion**. For example, one patient of ours was plagued by thoughts that she would cause harm to her young daughter. She experienced intrusive images of throwing hot coffee in her daughter’s face or pushing her face underwater when she was giving her a bath. These images were so terrifying to the patient that she would no longer allow herself any physical contact with her daughter and would leave her daughter in the care of a babysitter if her husband or another family was not available to “supervise” her. In reality, the last thing she wanted to do was harm her daughter, and she had no intention or desire to act on the aggressive thoughts and images, nor does anybody with OCD act on these thoughts, but these thoughts were so horrifying to her that she made every attempt to prevent herself from the potential of carrying them out, even if it meant not being able to hold, cradle, or cuddle her daughter. These are the types of struggles people with OCD face every day.

Treatments for Anxiety and Related Disorders

Many successful treatments for anxiety and related disorders have been developed over the years. Medications (anti-anxiety drugs and antidepressants) have been found to be beneficial for disorders other than specific phobia, but relapse rates are high once medications are stopped (**Heimberg et al., 1998; Hollon et al., 2005**), and some classes of medications (minor tranquilizers or benzodiazepines) can be habit forming.



Exposure-based CBT aims to help patients recognize and change problematic thoughts and behaviors in real-life situations. A person with a fear of elevators would be encouraged to practice exposure exercises that might involve approaching or riding elevators to attempt to overcome their anxiety. [Image: Mag3737, <https://goo.gl/j9L5AQ>, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

Exposure-based cognitive behavioral therapies (CBT) are effective psychosocial treatments for anxiety disorders, and many show greater treatment effects than medication in the long term (**Barlow, Allen, & Basden, 2007; Barlow, Gorman, Shear, & Woods, 2000**). In CBT, patients are taught skills to help identify and change problematic thought processes, beliefs, and behaviors that tend to worsen symptoms of anxiety, and practice applying these skills to real-life situations through exposure exercises.

Patients learn how the automatic “appraisals” or thoughts they have about a situation affect both how they feel and how they behave. Similarly, patients learn how engaging in certain behaviors, such as avoiding situations, tends to strengthen the belief that the

situation is something to be feared. A key aspect of CBT is exposure exercises, in which the patient learns to gradually approach situations they find fearful or distressing, in order to challenge their beliefs and learn new, less fearful associations about these situations.

Typically 50% to 80% of patients receiving drugs or CBT will show a good initial response, with the effect of CBT more durable. Newer developments in the treatment of anxiety disorders are focusing on novel interventions, such as the use of certain medications to enhance learning during CBT (**Otto et al., 2010**), and transdiagnostic treatments targeting core, underlying vulnerabilities (**Barlow et al., 2011**). As we advance our understanding of anxiety and related disorders, so too will our treatments advance, with the hopes that for the many people suffering from these disorders, anxiety can once again become something useful and adaptive, rather than something debilitating.

1. Kessler et al. (2005).
2. Kessler, Chiu, Demler, Merikangas, & Walters (2005).
3. Kessler, Sonnega, Bromet, Hughes, & Nelson (1995).
4. Craske et al. (1996).

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Agoraphobia

A sort of anxiety disorder distinguished by feelings that a place is uncomfortable or may be unsafe because it is significantly open or crowded.

Anxiety

A mood state characterized by negative affect, muscle tension, and physical arousal in which a person apprehensively anticipates future danger or misfortune.

Biological vulnerability

A specific genetic and neurobiological factor that might

predispose someone to develop anxiety disorders.

Conditioned response

A learned reaction following classical conditioning, or the process by which an event that automatically elicits a response is repeatedly paired with another neutral stimulus (conditioned stimulus), resulting in the ability of the neutral stimulus to elicit the same response on its own.

External cues

Stimuli in the outside world that serve as triggers for anxiety or as reminders of past traumatic events.

Fight or flight response

A biological reaction to alarming stressors that prepares the body to resist or escape a threat.

Flashback

Sudden, intense re-experiencing of a previous event, usually trauma-related.

Generalized anxiety disorder (GAD)

Excessive worry about everyday things that is at a level that is out of proportion to the specific causes of worry.

Internal bodily or somatic cues

Physical sensations that serve as triggers for anxiety or as reminders of past traumatic events.

Interoceptive avoidance

Avoidance of situations or activities that produce sensations of physical arousal similar to those occurring during a panic attack or intense fear response.

Obsessive-compulsive disorder (OCD)

A disorder characterized by the desire to engage in certain behaviors excessively or compulsively in hopes of reducing

anxiety. Behaviors include things such as cleaning, repeatedly opening and closing doors, hoarding, and obsessing over certain thoughts.

Panic disorder (PD)

A condition marked by regular strong panic attacks, and which may include significant levels of worry about future attacks.

Posttraumatic stress disorder (PTSD)

A sense of intense fear, triggered by memories of a past traumatic event, that another traumatic event might occur. PTSD may include feelings of isolation and emotional numbing.

Psychological vulnerabilities

Influences that our early experiences have on how we view the world.

Reinforced response

Following the process of operant conditioning, the strengthening of a response following either the delivery of a desired consequence (positive reinforcement) or escape from an aversive consequence.

SAD performance only

Social anxiety disorder which is limited to certain situations that the sufferer perceives as requiring some type of performance.

Social anxiety disorder (SAD)

A condition marked by acute fear of social situations which lead to worry and diminished day to day functioning.

Specific vulnerabilities

How our experiences lead us to focus and channel our anxiety.

Thought-action fusion

The tendency to overestimate the relationship between a thought and an action, such that one mistakenly believes a “bad” thought is the equivalent of a “bad” action.

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55. History of Mental Illness

Original chapter by Ingrid G Farreras
adapted by the Queen's University
Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link:

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This module is divided into three parts. The first is a brief introduction to various criteria we use to define or distinguish between normality and abnormality. The second, largest part is a history of mental illness from the Stone Age to the 20th century, with a special emphasis on the recurrence of three causal explanations for mental illness; supernatural, somatogenic, and psychogenic factors. This part briefly touches upon trephination, the Greek theory of hysteria within the context of the four bodily humors, witch hunts, asylums, moral treatment, mesmerism, catharsis, the mental hygiene movement, deinstitutionalization, community mental health services, and managed care. The third part concludes with a brief description of the issue of diagnosis.

Learning Objectives

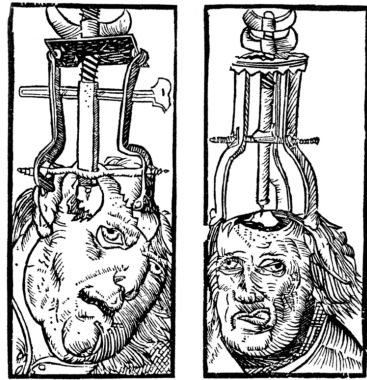
- Identify what the criteria used to distinguish normality from abnormality are.
- Understand the difference among the three main etiological theories of mental illness.
- Describe specific beliefs or events in history that exemplify each of these etiological theories (e.g., hysteria, humorism, witch hunts, asylums, moral treatments).
- Explain the differences in treatment facilities for the mentally ill (e.g., mental hospitals, asylums, community mental health centers).
- Describe the features of the “moral treatment” approach used by Chiarughi, Pinel, and Tuke.
- Describe the reform efforts of Dix and Beers and the outcomes of their work.
- Describe Kräpelin’s classification of mental illness and the current DSM system.

History of Mental Illness

References to mental illness can be found throughout history. The evolution of mental illness, however, has not been linear or progressive but rather cyclical. Whether a behavior is considered normal or abnormal depends on the context surrounding the behavior and thus changes as a function of a particular time and culture. In the past, uncommon behavior or behavior that deviated from the sociocultural norms and expectations of a specific culture and period has been used as a way to silence or control certain individuals or groups. As a result, a less **cultural relativist** view of abnormal behavior has focused instead on whether behavior poses a threat to oneself or others or causes so much pain and suffering that it interferes

with one's work responsibilities or with one's relationships with family and friends.

Throughout history there have been three general theories of the **etiology** of mental



Engravings from 1525 showing trephination. It was believed that drilling holes in the skull could cure mental disorders. [Image: Peter Treveris, CCO Public Domain, <https://goo.gl/m25gce>]

illness: **supernatural**, **somatogenic**, and **psychogenic**. Supernatural theories attribute mental illness to possession by evil or demonic spirits, displeasure of gods, eclipses, planetary gravitation, curses, and sin. Somatogenic theories identify disturbances in physical functioning resulting from either illness, genetic inheritance, or brain damage or imbalance. Psychogenic theories focus on traumatic or stressful experiences, **maladaptive** learned associations and cognitions, or distorted perceptions. Etiological theories of mental illness determine the care and treatment mentally ill individuals receive. As we will see below, an individual believed to be possessed by the devil will be viewed and treated differently from an individual believed to be suffering from an excess of yellow bile. Their treatments will also differ, from exorcism to blood-letting. The theories, however, remain the same. They coexist as well as recycle over time.

Trephination is an example of the earliest supernatural

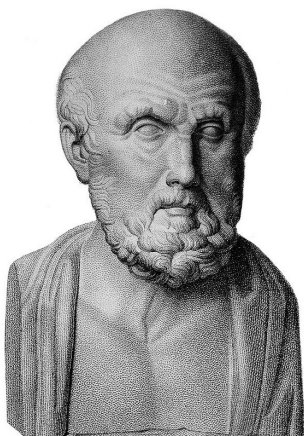
explanation for mental illness. Examination of prehistoric skulls and cave art from as early as 6500 BC has identified surgical drilling of holes in skulls to treat head injuries and epilepsy as well as to allow evil spirits trapped within the skull to be released (**Restak, 2000**). Around 2700 BC, Chinese medicine's concept of complementary positive and negative bodily forces ("yin and yang") attributed mental (and physical) illness to an imbalance between these forces. As such, a harmonious life that allowed for the proper balance of yin and yang and movement of vital air was essential (**Tseng, 1973**).

Mesopotamian and Egyptian papyri from 1900 BC describe women suffering from mental illness resulting from a wandering uterus (later named **hysteria** by the Greeks): The uterus could become dislodged and attached to parts of the body like the liver or chest cavity, preventing their proper functioning or producing varied and sometimes painful symptoms. As a result, the Egyptians, and later the Greeks, also employed a somatogenic treatment of strong smelling substances to guide the uterus back to its proper location (pleasant odors to lure and unpleasant ones to dispel).

Throughout classical antiquity we see a return to supernatural theories of demonic possession or godly displeasure to account for abnormal behavior that was beyond the person's control. Temple attendance with religious healing ceremonies and incantations to the gods were employed to assist in the healing process. Hebrews saw madness as punishment from God, so treatment consisted of confessing sins and repenting. Physicians were also believed to be able to comfort and cure madness, however.

Greek physicians rejected supernatural explanations of mental disorders. It was around 400 BC that Hippocrates (460–370 BC) attempted to separate superstition and religion from medicine by systematizing the belief that a deficiency in or especially an excess of one of the four essential bodily fluids (i.e., humors)—blood, yellow bile, black bile, and phlegm—was

responsible for physical and mental illness. For example, someone who was too temperamental suffered from too much blood and thus blood-letting would be the necessary treatment. Hippocrates classified mental illness into one of four categories—epilepsy, mania, melancholia, and brain fever—and like other prominent physicians and philosophers of his time, he did not believe mental illness was shameful or that mentally ill individuals should be held accountable for their behavior. Mentally ill individuals were cared for at home by family members and the state shared no responsibility for their care. **Humorism** remained a recurrent somatogenic theory up until the 19th century.



Many of Hippocrates' medical theories are no longer practiced today. However, he pioneered medicine as an empirical practice and came up with the "Hippocratic oath," which all doctors must swear to before joining the profession (i.e., the promise to never intentionally harm a patient). [Image: Wellcome Images, <https://goo.gl/dX2lyj>, CC BY 4.0, <https://goo.gl/FJluOM>]

While Greek physician Galen (AD 130–201) rejected the notion of a uterus having an **animistic soul**, he agreed with the notion that an imbalance of the four bodily fluids could cause mental illness. He also opened the door for psychogenic explanations for mental illness, however, by allowing for the experience of psychological stress as a potential cause of abnormality. Galen's psychogenic theories were ignored for centuries, however, as physicians attributed mental illness to physical causes throughout most of the millennium.

By the late Middle Ages, economic and political turmoil threatened the power of the

Roman Catholic church. Between the 11th and 15th centuries, supernatural theories of mental disorders again dominated Europe, fueled by natural disasters like plagues and famines that lay people interpreted as brought about by the devil. Superstition, astrology, and alchemy took hold, and common treatments included prayer rites, relic touching, confessions, and atonement. Beginning in the 13th century the mentally ill, especially women, began to be persecuted as witches who were possessed. At the height of the witch hunts during the 15th through 17th centuries, with the Protestant Reformation having plunged Europe into religious strife, two Dominican monks wrote the *Malleus Maleficarum* (1486) as the ultimate manual to guide witch hunts. Johann Weyer and Reginald Scot tried to convince people in the mid- to late-16th century that accused witches were actually women with mental illnesses and that mental illness was not due to demonic possession but to faulty metabolism and disease, but the Church's Inquisition banned both of their writings. Witch-hunting did not decline until the 17th and 18th centuries, after more than 100,000 presumed witches had been burned at the stake (Schoeneman, 1977; Zilboorg & Henry, 1941).

Modern treatments of mental illness are most associated with the establishment of hospitals and **asylums** beginning in the 16th century. Such institutions' mission was to house and confine the mentally ill, the poor, the homeless, the unemployed, and the criminal. War and economic depression produced vast numbers of undesirables and these were separated from society and sent to these institutions. Two of the most well-known institutions, St. Mary of Bethlehem in London, known as Bedlam, and the Hôpital Général of Paris—which included La Salpêtrière, La Pitié, and La Bicêtre—began housing mentally ill patients in the mid-16th and 17th centuries. As confinement laws focused on protecting the public *from* the mentally ill, governments became responsible for housing and feeding undesirables in exchange

for their personal liberty. Most inmates were institutionalized against their will, lived in filth and chained to walls, and were commonly exhibited to the public for a fee. Mental illness was nonetheless viewed somatogenically, so treatments were similar to those for physical illnesses: purges, bleedings, and emetics.

While inhumane by today's standards, the view of insanity at the time likened the mentally ill to animals (i.e., animalism) who did not have the capacity to reason, could not control themselves, were capable of violence without provocation, did not have the same physical sensitivity to pain or temperature, and could live in miserable conditions without complaint. As such, instilling fear was believed to be the best way to restore a disordered mind to reason.

By the 18th century, protests rose over the conditions under which the mentally ill lived, and the 18th and 19th centuries saw the growth of a more humanitarian view of mental illness. In 1785 Italian physician Vincenzo Chiarughi (1759–1820) removed the chains of patients at his St. Boniface hospital in Florence, Italy, and encouraged good hygiene and recreational and occupational training. More well known, French physician Philippe Pinel (1745–1826) and former patient Jean-Baptiste Pussin created a “**traitement moral**” at La Bicêtre and the Salpêtrière in 1793 and 1795 that also included unshackling patients, moving them to well-aired, well-lit rooms, and encouraging purposeful activity and freedom to move about the grounds (Micale, 1985).

In England, humanitarian reforms rose from religious concerns. William Tuke (1732–1822) urged the Yorkshire Society of (Quaker) Friends to establish the York Retreat in 1796, where patients were guests, not prisoners, and where the standard of care depended on dignity and courtesy as well as the therapeutic and moral value of physical work (Bell, 1980).

While America had asylums for the mentally ill—such as the Pennsylvania Hospital in Philadelphia and the Williamsburg Hospital, established in 1756 and 1773—the somatogenic theory of mental illness of the time—promoted especially by the father of American psychiatry, Benjamin Rush (1745–1813)—had led to treatments such as blood-letting, gyrotors, and tranquilizer chairs. When Tuke’s York Retreat became the model for half of the new



Dorothea Dix worked to change the negative perceptions of people with mental illness and helped create institutions where they could receive compassionate care. [Image: State Archives of North Carolina, <https://goo.gl/wRgGsi>, no known copyright restrictions]

private asylums established in the United States, however, psychogenic treatments such as compassionate care and physical labor became the hallmarks of the new American asylums, such as the Friends Asylum in Frankford, Pennsylvania, and the Bloomingdale Asylum in New York City, established in 1817 and 1821 (Grob, 1994).

Moral treatment had to be abandoned in America in the second half of the 19th century, however, when these asylums became overcrowded and custodial in nature and could no longer provide the space nor attention necessary. When retired school teacher Dorothea Dix discovered the negligence that resulted from such conditions, she advocated for the establishment of state hospitals. Between 1840 and 1880, she helped establish over 30 mental institutions in the United States and Canada (Viney & Zorich, 1982). By the late 19th century, moral treatment had given way to the mental hygiene movement, founded by former patient Clifford Beers with the publication of his 1908 memoir *A Mind That Found Itself*.

Riding on Pasteur's breakthrough germ theory of the 1860s and 1870s and especially on the early 20th century discoveries of vaccines for cholera, syphilis, and typhus, the mental hygiene movement reverted to a somatogenic theory of mental illness.

European psychiatry in the late 18th century and throughout the 19th century, however, struggled between somatogenic and psychogenic explanations of mental illness, particularly hysteria, which caused physical symptoms such as blindness or paralysis with no apparent physiological explanation. Franz Anton Mesmer (1734–1815), influenced by contemporary discoveries in electricity, attributed hysterical symptoms to imbalances in a universal magnetic fluid found in individuals, rather than to a wandering uterus (**Forrest, 1999**). James Braid (1795–1860) shifted this belief in **mesmerism** to one in hypnosis, thereby proposing a psychogenic treatment for the removal of symptoms. At the time, famed Salpetriere Hospital neurologist Jean-Martin Charcot (1825–1893), and Ambroise Auguste Liébault (1823–1904) and Hyppolyte Bernheim (1840–1919) of the Nancy School in France, were engaged in a bitter etiological battle over hysteria, with Charcot maintaining that the hypnotic suggestibility underlying hysteria was a neurological condition while Liébault and Bernheim believed it to be a general trait that varied in the population. Josef Breuer (1842–1925) and Sigmund Freud (1856–1939) would resolve this dispute in favor of a psychogenic explanation for mental illness by treating hysteria through hypnosis, which eventually led to the **cathartic method** that became the precursor for psychoanalysis during the first half of the 20th century.

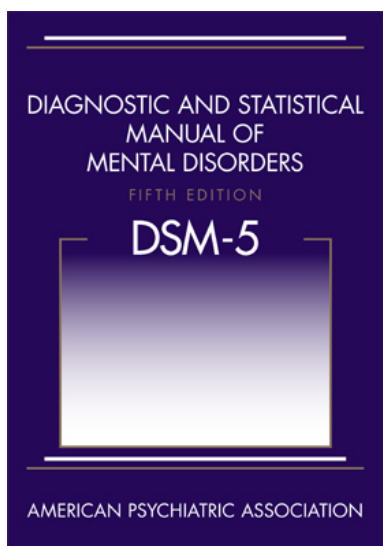
Psychoanalysis was the dominant psychogenic treatment for mental illness during the first half of the 20th century, providing the launching pad for the more than 400 different schools of psychotherapy found today (**Magnavita, 2006**). Most of these schools cluster around broader behavioral, cognitive, cognitive-behavioral, psychodynamic, and client-centered approaches to psychotherapy applied in individual, marital,

family, or group formats. Negligible differences have been found among all these approaches, however; their efficacy in treating mental illness is due to factors shared among all of the approaches (not particular elements specific to each approach): the therapist-patient alliance, the therapist's allegiance to the therapy, therapist competence, and placebo effects (Luborsky et al., 2002; Messer & Wampold, 2002).

In contrast, the leading somatogenic treatment for mental illness can be found in the establishment of the first psychotropic medications in the mid-20th century. Restraints, electro-convulsive shock therapy, and lobotomies continued to be employed in American state institutions until the 1970s, but they quickly made way for a burgeoning pharmaceutical industry that has viewed and treated mental illness as a chemical imbalance in the brain.

Both etiological theories coexist today in what the psychological discipline holds as the **biopsychosocial model** of explaining human behavior. While individuals may be born with a genetic predisposition for a certain psychological disorder, certain psychological stressors need to be present for them to develop the disorder. Sociocultural factors such as sociopolitical or economic unrest, poor living conditions, or problematic interpersonal relationships are also viewed as contributing factors. However much we want to believe that we are above the treatments described above, or that the present is always the most enlightened time, let us not forget that our thinking today continues to reflect the same underlying somatogenic and psychogenic theories of mental illness discussed throughout this cursory 9,000-year history.

Diagnosis of Mental Illness



Up until the 1970's, homosexuality was included in the DSM as a psychological disorder. Thankfully, society and clinical understanding changed to recognize it didn't belong. [Image: Rene Walter, <https://goo.gl/CcJAA1>, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

Progress in the treatment of mental illness necessarily implies improvements in the diagnosis of mental illness. A standardized diagnostic classification system with agreed-upon definitions of psychological disorders creates a shared language among mental-health providers and aids in clinical research. While diagnoses were recognized as far back as the Greeks, it was not until 1883 that German psychiatrist Emil Kräpelin (1856–1926) published a comprehensive system of psychological disorders that centered around a pattern of symptoms (i.e., **syndrome**) suggestive of an underlying

physiological cause. Other clinicians also suggested popular classification systems but the need for a single, shared system paved the way for the American Psychiatric Association's 1952 publication of the first *Diagnostic and Statistical Manual* (DSM).

The DSM has undergone various revisions (in 1968, 1980, 1987, 1994, 2000, 2013), and it is the 1980 DSM-III version that began a multiaxial classification system that took into account the entire individual rather than just the specific problem behavior. Axes I and II contain the clinical diagnoses, including intellectual disability and personality disorders. Axes III and IV

list any relevant medical conditions or psychosocial or environmental stressors, respectively. Axis V provides a global assessment of the individual's level of functioning. The most recent version — the DSM-5— has combined the first three axes and removed the last two. These revisions reflect an attempt to help clinicians streamline diagnosis and work better with other diagnostic systems such as health diagnoses outlined by the World Health Organization.

While the DSM has provided a necessary shared language for clinicians, aided in clinical research, and allowed clinicians to be reimbursed by insurance companies for their services, it is not without criticism. The DSM is based on clinical and research findings from Western culture, primarily the United States. It is also a medicalized categorical classification system that assumes disordered behavior does not differ in degree but in kind, as opposed to a dimensional classification system that would plot disordered behavior along a continuum. Finally, the number of diagnosable disorders has tripled since it was first published in 1952, so that almost half of Americans will have a diagnosable disorder in their lifetime, contributing to the continued concern of labeling and stigmatizing mentally ill individuals. These concerns appear to be relevant even in the DSM-5 version that came out in May of 2013.

Beyond the DSM

Although the DSM is a commonly used tool in North America for diagnosing mental illness, it is not the only tool. Dr. Meredith Chivers is a psychological scientist at Queen's University. She notes that the DSM 5 reflects the perspectives of American psychiatry. A more global perspective is represented by the International Classification of Diseases, 11th revision, (ICD-11) created by the World Health Organization. This manual

provides a diagnostic classification standard for all health conditions, including mental health, for the purposes of clinical practice and research. There are some differences between the DSM 5 and ICD-11. For example, Gender Incongruence, that is, a discordance between experienced gender and the assigned sex, is not listed as a mental disorder in the ICD-11, but a condition related to sexual health. In the DSM 5, this phenomenon is termed “gender dysphoria” and considered a mental disorder.

Check Your Knowledge

To help you with your studying, we’ve included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Animism

The belief that everyone and everything had a “soul” and that mental illness was due to animistic causes, for example, evil spirits controlling an individual and their behavior.

Asylum

A place of refuge or safety established to confine and care for the mentally ill; forerunners of the mental hospital or psychiatric facility.

Biopsychosocial model

A model in which the interaction of biological, psychological, and sociocultural factors is seen as influencing the development of the individual.

Cathartic method

A therapeutic procedure introduced by Breuer and developed further by Freud in the late 19th century whereby a patient gains insight and emotional relief from recalling and reliving traumatic events.

Cultural relativism

The idea that cultural norms and values of a society can only be understood on their own terms or in their own context.

Etiology

The causal description of all of the factors that contribute to the development of a disorder or illness.

Humorism (or humoralism)

A belief held by ancient Greek and Roman physicians (and until the 19th century) that an excess or deficiency in any of the four bodily fluids, or humors—blood, black bile, yellow bile, and phlegm—directly affected their health and temperament.

Hysteria

Term used by the ancient Greeks and Egyptians to describe a disorder believed to be caused by a woman's uterus wandering throughout the body and interfering with other organs (today referred to as conversion disorder, in which psychological problems are expressed in physical form).

Maladaptive

Term referring to behaviors that cause people who have them physical or emotional harm, prevent them from functioning in daily life, and/or indicate that they have lost touch with reality and/or cannot control their thoughts and behavior (also called dysfunctional).

Mesmerism

Derived from Franz Anton Mesmer in the late 18th century, an early version of hypnotism in which Mesmer claimed that hysterical symptoms could be treated through animal magnetism emanating from Mesmer's body and permeating the universe (and later through magnets); later explained in terms of high suggestibility in individuals.

Psychogenesis

Developing from psychological origins.

Somatogenesis

Developing from physical/bodily origins.

Supernatural

Developing from origins beyond the visible observable universe.

Syndrome

Involving a particular group of signs and symptoms.

“Traitement moral” (moral treatment)

A therapeutic regimen of improved nutrition, living conditions, and rewards for productive behavior that has been attributed to Philippe Pinel during the French Revolution, when he released mentally ill patients from their restraints and treated them with compassion and dignity rather than with contempt and denigration.

Trephination

The drilling of a hole in the skull, presumably as a way of treating psychological disorders.

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PSYC 100 XX

PSYCHOPATHOLOGY II

56. Depressive Disorders & Bipolar and Related Disorders

Original chapter by Anda Gershon and
Renee Thompson adapted by the Queen's
University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below. We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link:
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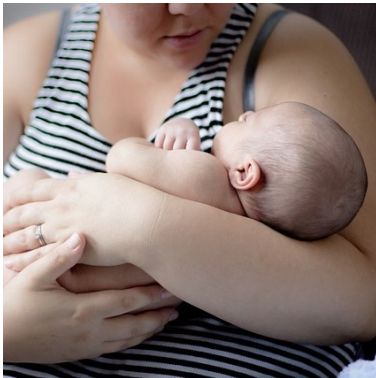
Everyone feels down or euphoric from time to time, but this is different from having a mood disorder such as major depressive disorder or bipolar disorder. Mood disorders are extended periods of depressed, euphoric, or irritable moods that in combination with other symptoms cause the person significant distress and interfere with his or her daily life, often resulting in social and occupational difficulties. In this module, we describe major mood disorders, including their symptom presentations, general prevalence rates, and how and why the rates of these disorders tend to vary by age, gender, and race. In addition, biological and environmental risk factors that have been implicated in the development and course of mood disorders, such as heritability and stressful life events, are reviewed. Finally, we provide an overview of treatments for

mood disorders, covering treatments with demonstrated effectiveness, as well as new treatment options showing promise.

It is important to note that although “mood disorders” may be used in this chapter, the DSM-5 uses the classifications of “Depressive Disorders” and “Bipolar and Related Disorders.”

Learning Objectives

- Describe the diagnostic criteria for mood disorders.
- Understand age, gender, and ethnic differences in prevalence rates of mood disorders.
- Identify common risk factors for mood disorders.
- Know effective treatments of mood disorders.



Perinatal depression following child birth afflicts about 5% of all mothers. An unfortunate social stigma regarding this form of depression compounds the problem for the women who suffer its effects. [Image: CCO Public Domain]

The actress Brooke Shields published a memoir titled **Down Came the Rain: My Journey through Postpartum Depression** in which she described her struggles with depression following the birth of her daughter. Despite the fact that about one in 20 women experience depression after the birth of a baby (American Psychiatric Association [APA], 2013), postpartum depression—recently renamed “perinatal depression”—continues to be

veiled by stigma, owing in part to a widely held expectation that motherhood should be a time of great joy. In an opinion

piece in the *New York Times*, Shields revealed that entering motherhood was a profoundly overwhelming experience for her. She vividly describes experiencing a sense of “doom” and “dread” in response to her newborn baby. Because motherhood is conventionally thought of as a joyous event and not associated with sadness and hopelessness, responding to a newborn baby in this way can be shocking to the new mother as well as those close to her. It may also involve a great deal of shame for the mother, making her reluctant to divulge her experience to others, including her doctors and family.

Feelings of shame are not unique to perinatal depression. Stigma applies to other types of depressive and bipolar disorders and contributes to people not always receiving the necessary support and treatment for these disorders. In fact, the World Health Organization ranks both major depressive disorder (MDD) and bipolar disorder (BD) among the top 10 leading causes of disability worldwide. Further, MDD and BD carry a high risk of suicide. It is estimated that 25%–50% of people diagnosed with BD will attempt suicide at least once in their lifetimes (Goodwin & Jamison, 2007).

What Are Mood Disorders?

Mood Episodes

Everyone experiences brief periods of sadness, irritability, or euphoria. This is different than having a mood disorder, such as MDD or BD, which are characterized by a constellation of symptoms that causes people significant distress or impairs their everyday functioning.

Major Depressive Episode

A major depressive episode (MDE) refers to symptoms that co-occur for at least two weeks and cause significant distress or impairment in functioning, such as interfering with work, school, or relationships. Core symptoms include feeling down or depressed or experiencing **anhedonia**—loss of interest or pleasure in things that one typically enjoys. According to the fifth edition of the *Diagnostic and Statistical Manual (DSM-5; APA, 2013)*, the criteria for an MDE require five or more of the following nine symptoms, including one or both of the first two symptoms, for most of the day, nearly every day:

1. depressed mood
2. diminished interest or pleasure in almost all activities
3. significant weight loss or gain or an increase or decrease in appetite
4. insomnia or **hypersomnia**
5. **psychomotor agitation** or **retardation**
6. fatigue or loss of energy
7. feeling worthless or excessive or inappropriate guilt
8. diminished ability to concentrate or indecisiveness
9. recurrent thoughts of death, **suicidal ideation**, or a suicide attempt

These symptoms cannot be caused by physiological effects of a substance or a general medical condition (e.g., hypothyroidism).

Manic or Hypomanic Episode

The core criterion for a manic or hypomanic episode is a distinct period of abnormally and persistently euphoric,

expansive, or irritable mood and persistently increased goal-directed activity or energy. The mood disturbance must be present for one week or longer in mania (unless hospitalization is required) or four days or longer in hypomania. Concurrently, at least three of the following symptoms must be present in the context of euphoric mood (or at least four in the context of irritable mood):

1. inflated self-esteem or **grandiosity**
2. increased goal-directed activity or psychomotor agitation
3. reduced need for sleep
4. racing thoughts or flight of ideas
5. distractibility
6. increased talkativeness
7. excessive involvement in risky behaviors

Manic episodes are distinguished from hypomanic episodes by their duration and associated impairment; whereas manic episodes must last one week and are defined by a significant impairment in functioning, hypomanic episodes are shorter and not necessarily accompanied by impairment in functioning.

Mood Disorders

Unipolar Mood Disorders

Two major types of unipolar disorders described by the *DSM-5* (APA, 2013) are major depressive disorder and persistent depressive disorder (PDD; dysthymia). MDD is defined by one or more MDEs, but no history of manic or hypomanic episodes. Criteria for PDD are feeling depressed most of the day for more

days than not, for at least two years. At least two of the following symptoms are also required to meet criteria for PDD:

1. poor appetite or overeating
2. insomnia or hypersomnia
3. low energy or fatigue
4. low self-esteem
5. poor concentration or difficulty making decisions
6. feelings of hopelessness

Like MDD, these symptoms need to cause significant distress or impairment and cannot be due to the effects of a substance or a general medical condition. To meet criteria for PDD, a person cannot be without symptoms for more than two months at a time. PDD has overlapping symptoms with MDD. If someone meets criteria for an MDE during a PDD episode, the person will receive diagnoses of PDD and MDD.

Bipolar Mood Disorders

Three major types of BDs are described by the *DSM-5* (APA, 2013). Bipolar I Disorder (BD I), which was previously known as manic-depression, is characterized by a single (or recurrent) manic episode. A depressive episode is not necessary but commonly present for the diagnosis of BD I. Bipolar II Disorder is characterized by single (or recurrent) hypomanic episodes and depressive episodes. Another type of BD is cyclothymic disorder, characterized by



Bipolar disorders are characterized by cycles of high energy and depression. [Image: "Bipolar" by Jessi RM is licensed under CC BY-NC-ND 2.0]

numerous and alternating periods of hypomania and depression, lasting at least two years. To qualify for cyclothymic disorder, the periods of depression cannot meet full diagnostic criteria for an MDE; the person must experience symptoms at least half the time with no more than two consecutive symptom-free months; and the symptoms must cause significant distress or impairment.

Box 1. Specifiers

Both MDEs and manic episodes can be further described using standardized tags based on the timing of, or other symptoms that are occurring during, the mood episode, to increase diagnostic specificity and inform treatment. Psychotic features is specified when the episodes are accompanied by delusions (rigidly held beliefs that are false) or hallucinations (perceptual disturbances that are not based in reality). Seasonal pattern is specified when a mood episode occurs at the same time of the year for two consecutive years—most commonly occurring in the fall and winter. Peripartum onset is specified when a mood episode has an onset during pregnancy or within four weeks of the birth of a child. Approximately 3%–6% of women who have a child experience an MDE with peripartum onset (APA, 2013). This is less frequent and different from the baby blues or when women feel transient mood symptoms usually within 10 days of giving birth, which are experienced by most women (Nolen-Hoeksema & Hilt, 2009).

It is important to note that the *DSM-5* was published in 2013, and findings based on the updated manual will be forthcoming. Consequently, the research presented below was largely based on a similar, but not identical, conceptualization of mood disorders drawn from the *DSM-IV* (APA, 2000).

How Common Are Mood Disorders? Who Develops Mood Disorders?

Depressive Disorders

In a nationally representative sample, lifetime prevalence rate for MDD is 16.6% (Kessler, Berglund, Demler, Jin, Merikangas, & Walters, 2005). This means that nearly one in five Americans will meet the criteria for MDD during their lifetime. The 12-month prevalence—the proportion of people who meet criteria for a disorder during a 12-month period—for PDD is approximately 0.5% (APA, 2013).

Although the onset of MDD can occur at any time throughout the lifespan, the average age of onset is mid-20s, with the age of onset decreasing with people born more recently (APA, 2000). Prevalence of MDD among older adults is much lower than it is for younger cohorts (Kessler, Birnbaum, Bromet, Hwang, Sampson, & Shahly, 2010). The duration of MDEs varies widely. Recovery begins within three months for 40% of people with MDD and within 12 months for 80% (APA, 2013). MDD tends to be a recurrent disorder with about 40%–50% of those who experience one MDE experiencing a second MDE (Monroe & Harkness, 2011). An earlier age of onset predicts a worse course. About 5%–10% of people who experience an MDE will later experience a manic episode (APA, 2000), thus no longer meeting criteria for MDD but instead

meeting them for BD I. Diagnoses of other disorders across the lifetime are common for people with MDD: 59% experience an anxiety disorder; 32% experience an impulse control disorder, and 24% experience a substance use disorder (**Kessler, Merikangas, & Wang, 2007**).

Women experience two to three times higher rates of MDD than do men (**Nolen-Hoeksema & Hilt, 2009**). This gender difference emerges during puberty (**Conley & Rudolph, 2009**). Before puberty, boys exhibit similar or higher prevalence rates of MDD than do girls (**Twenge & Nolen-Hoeksema, 2002**). MDD is inversely correlated with **socioeconomic status** (SES), a person's economic and social position based on income, education, and occupation. Higher prevalence rates of MDD are associated with lower SES (**Lorant, Deliege, Eaton, Robert, Philippot, & Anseau, 2003**), particularly for adults over 65 years old (**Kessler et al., 2010**). Independent of SES, results from a nationally representative sample found that European Americans had a higher prevalence rate of MDD than did African Americans and Hispanic Americans, whose rates were similar (**Breslau, Aguilar-Gaxiola, Kendler, Su, Williams, & Kessler, 2006**). The course of MDD for African Americans is often more severe and less often treated than it is for European Americans, however (**Williams et al., 2007**). Native Americans have a higher prevalence rate than do European Americans, African Americans, or Hispanic Americans (**Hasin, Goodwin, Stinson & Grant, 2005**). Depression is not limited to industrialized or western cultures; it is found in all countries that have been examined, although the symptom presentation as well as prevalence rates vary across cultures (**Chentsova-Dutton & Tsai, 2009**).

Bipolar Disorders



Adolescents experience a higher incidence of bipolar spectrum disorders than do adults. Making matters worse, those who are diagnosed with BD at a younger age seem to suffer symptoms more intensely than those with adult onset. [Image: CC0 Public Domain]

The lifetime prevalence rate of bipolar spectrum disorders in the general U.S. population is estimated at approximately 4.4%, with BD I constituting about 1% of this rate (**Merikangas et al., 2007**). Prevalence estimates, however, are highly dependent on the diagnostic procedures used (e.g., interviews vs. self-report) and whether or not sub-threshold forms of the disorder are included in the estimate. BD often co-occurs with other psychiatric disorders. Approximately 65%

of people with BD meet diagnostic criteria for at least one additional psychiatric disorder, most commonly anxiety disorders and substance use disorders (**McElroy et al., 2001**).

The co-occurrence of BD with other psychiatric disorders is associated with poorer illness course, including higher rates of suicidality (**Leverich et al., 2003**). A recent cross-national study sample of more than 60,000 adults from 11 countries, estimated the worldwide prevalence of BD at 2.4%, with BD I constituting 0.6% of this rate (**Merikangas et al., 2011**). In this study, the prevalence of BD varied somewhat by country.

Whereas the United States had the highest lifetime prevalence (4.4%), India had the lowest (0.1%). Variation in prevalence rates was not necessarily related to SES, as in the case of Japan, a high-income country with a very low prevalence rate of BD (0.7%).

With regard to ethnicity, data from studies not confounded by SES or inaccuracies in diagnosis are limited, but available reports suggest rates of BD among European Americans are similar to those found among African Americans (**Blazer et al., 1985**) and Hispanic Americans (**Breslau, Kendler, Su, Gaxiola-Aguilar, & Kessler, 2005**). Another large community-based study found that although prevalence rates of mood disorders were similar across ethnic groups, Hispanic Americans and African Americans with a mood disorder were more likely to remain persistently ill than European Americans (**Breslau et al., 2005**). Compared with European Americans with BD, African Americans tend to be underdiagnosed for BD (and overdiagnosed for schizophrenia) (Kilbourne, Haas, Mulsant, Bauer, & Pincus, **2004**; Minsky, Vega, Miskimen, Gara, & Escobar, **2003**), and Hispanic Americans with BD have been shown to receive fewer psychiatric medication prescriptions and specialty treatment visits (**Gonzalez et al., 2007**). Misdiagnosis of BD can result in the underutilization of treatment or the utilization of inappropriate treatment, and thus profoundly impact the course of illness.

As with MDD, adolescence is known to be a significant risk period for BD; mood symptoms start by adolescence in roughly half of BD cases (**Leverich et al., 2007**; **Perlis et al., 2004**). Longitudinal studies show that those diagnosed with BD prior to adulthood experience a more pernicious course of illness relative to those with adult onset, including more episode recurrence, higher rates of suicidality, and profound social, occupational, and economic repercussions (e.g., **Lewinsohn, Seeley, Buckley, & Klein, 2002**). The prevalence of BD is substantially lower in older adults compared with younger adults (1% vs. 4%) (**Merikangas et al., 2007**).

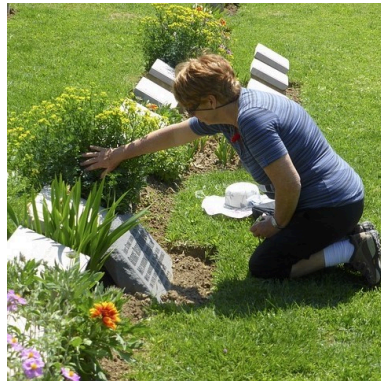
What Are Some of the Factors Implicated

in the Development and Course of Mood Disorders?

Mood disorders are complex disorders resulting from multiple factors. Causal explanations can be attempted at various levels, including biological and psychosocial levels. Below are several of the key factors that contribute to onset and course of mood disorders are highlighted.

Depressive Disorders

Research across family and twin studies has provided support that genetic factors are implicated in the development of MDD. Twin studies suggest that familial influence on MDD is mostly due to genetic effects and that individual-specific environmental effects (e.g., romantic relationships) play an important role, too. By contrast, the contribution of shared environmental effect by siblings is negligible



Romantic relationships can affect mood as in the case of divorce or the death of a spouse. [Image: CCO Public Domain]

(Sullivan, Neale & Kendler, **2000**) The mode of inheritance is not fully understood although no single genetic variation has been found to increase the risk of MDD significantly. Instead, several genetic variants and environmental factors most likely contribute to the risk for MDD (**Lohoff, 2010**).

One environmental stressor that has received much support in relation to MDD is stressful life events. In particular, severe

stressful life events—those that have long-term consequences and involve loss of a significant relationship (e.g., divorce) or economic stability (e.g., unemployment) are strongly related to depression (Brown & Harris, 1989; Monroe et al., 2009). Stressful life events are more likely to predict the first MDE than subsequent episodes (Lewinsohn, Allen, Seeley, & Gotlib, 1999). In contrast, minor events may play a larger role in subsequent episodes than the initial episodes (Monroe & Harkness, 2005).

Depression research has not been limited to examining reactivity to stressful life events. Much research, particularly brain imaging research using functional magnetic resonance imaging (fMRI), has centered on examining neural circuitry—the interconnections that allow multiple brain regions to perceive, generate, and encode information in concert. A meta-analysis of neuroimaging studies showed that when viewing negative stimuli (e.g., picture of an angry face, picture of a car accident), compared with healthy control participants, participants with MDD have greater activation in brain regions involved in stress response and reduced activation of brain regions involved in positively motivated behaviors (Hamilton, Etkin, Furman, Lemus, Johnson, & Gotlib, 2012).

Other environmental factors related to increased risk for MDD include experiencing **early adversity** (e.g., childhood abuse or neglect; Widom, DuMont, & Czaja, 2007), **chronic stress** (e.g., poverty) and interpersonal factors. For example, marital dissatisfaction predicts increases in depressive symptoms in both men and women. On the other hand, depressive symptoms also predict increases in marital dissatisfaction (Whisman & Uebelacker, 2009). Research has found that people with MDD generate some of their interpersonal stress (Hammen, 2005). People with MDD whose relatives or spouses can be described as critical and emotionally overinvolved have higher relapse rates than do

those living with people who are less critical and emotionally overinvolved (**Butzlaff & Hooley, 1998**).

People's **attributional styles** or their general ways of thinking, interpreting, and recalling information have also been examined in the etiology of MDD (**Gotlib & Joormann, 2010**). People with a pessimistic attributional style tend to make internal (versus external), global (versus specific), and stable (versus unstable) attributions to negative events, serving as a vulnerability to developing MDD. For example, someone who when he fails an exam thinks that it was his fault (internal), that he is stupid (global), and that he will always do poorly (stable) has a pessimistic attribution style. Several influential theories of depression incorporate attributional styles (**Abramson, Metalsky, & Alloy, 1989; Abramson Seligman, & Teasdale, 1978**).

Bipolar Disorders

Although there have been important advances in research on the etiology, course, and treatment of BD, there remains a need to understand the mechanisms that contribute to episode onset and relapse. There is compelling evidence for biological causes of BD, which is known to be highly heritable (**McGuffin, Rijdsdijk, Andrew, Sham, Katz, & Cardno, 2003**). It may be argued that a high rate of heritability demonstrates that BD is fundamentally a biological phenomenon. However, there is much variability in the course of BD both within a person across time and across people (**Johnson, 2005**). The triggers that determine how and when this genetic vulnerability is expressed are not yet understood; however, there is evidence to suggest that psychosocial triggers may play an important role in BD risk (e.g., **Johnson et al., 2008; Malkoff-Schwartz et al., 1998**).

In addition to the genetic contribution, biological explanations of BD have also focused on brain function. Many

of the studies using fMRI techniques to characterize BD have focused on the processing of emotional stimuli based on the idea that BD is fundamentally a disorder of emotion (APA, 2000). Findings show that regions of the brain thought to be involved in emotional processing and regulation are activated differently in people with BD relative to healthy controls (e.g., Altshuler et al., 2008; Hassel et al., 2008; Lennox, Jacob, Calder, Lupson, & Bullmore, 2004).

However, there is little consensus as to whether a particular brain region becomes more or less active in response to an emotional stimulus among people with BD compared with healthy controls. Mixed findings are in part due to samples consisting of participants who are at various phases of illness at the time of testing (manic, depressed, inter-episode). Sample sizes tend to be relatively small, making comparisons between subgroups difficult. Additionally, the use of a standardized stimulus (e.g., facial expression of anger) may not elicit a sufficiently strong response. Personally engaging stimuli, such as recalling a memory, may be more effective in inducing strong emotions (Isacowitz, Gershon, Allard, & Johnson, 2013).

Within the psychosocial level, research has focused on the environmental contributors to BD. A series of studies show that environmental stressors, particularly severe stressors (e.g., loss of a significant relationship), can adversely impact the course of BD. People with BD have substantially increased risk of relapse (Ellicott, Hammen, Gitlin, Brown, & Jamison, 1990) and suffer more depressive symptoms (Johnson, Winett, Meyer, Greenhouse, & Miller, 1999) following a severe life stressor. Interestingly, positive life events can also adversely impact the course of BD. People with BD suffer more manic symptoms after life events involving attainment of a desired goal (Johnson et al., 2008). Such findings suggest that people with BD may have a hypersensitivity to rewards.

Evidence from the life stress literature has also suggested that people with mood disorders may have a circadian

vulnerability that renders them sensitive to stressors that disrupt their sleep or rhythms. According to **social zeitgeber** theory (Ehlers, Frank, & Kupfer, **1988**; **Frank et al., 1994**), stressors that disrupt sleep, or that disrupt the daily routines that entrain the biological clock (e.g., meal times) can trigger episode relapse. Consistent with this theory, studies have shown that life events that involve a disruption in sleep and daily routines, such as overnight travel, can increase bipolar symptoms in people with BD (**Malkoff-Schwartz et al., 1998**).

What Are Some of the Well-Supported Treatments for Mood Disorders?

Depressive Disorders



A number of medications are effective in treating mood disorders. Meditation, exercise, counseling and other therapies also show effectiveness for some disorders. [Image: CC0 Public Domain]

There are many treatment options available for people with MDD. First, a number of antidepressant medications are available, all of which target one or more of the neurotransmitters implicated in depression. The earliest antidepressant medications were monoamine oxidase inhibitors (MAOIs). MAOIs inhibit monoamine oxidase, an enzyme involved in deactivating dopamine, norepinephrine, and serotonin. Although effective

in treating depression, MAOIs can have serious side effects. Patients taking MAOIs may develop dangerously high blood pressure if they take certain drugs (e.g., antihistamines) or eat foods containing tyramine, an amino acid commonly found in foods such as aged cheeses, wine, and soy sauce. Tricyclics, the second-oldest class of antidepressant medications, block the reabsorption of norepinephrine, serotonin, or dopamine at synapses, resulting in their increased availability. Tricyclics are most effective for treating vegetative and somatic symptoms of depression. Like MAOIs, they have serious side effects, the most concerning of which is being cardiotoxic. Selective serotonin reuptake inhibitors (SSRIs; e.g., Fluoxetine) and serotonin and norepinephrine reuptake inhibitors (SNRIs; e.g., Duloxetine) are the most recently introduced antidepressant medications. SSRIs, the most commonly prescribed antidepressant medication, block the reabsorption of serotonin, whereas SNRIs block the reabsorption of serotonin and norepinephrine. SSRIs and SNRIs have fewer serious side effects than do MAOIs and tricyclics. In particular, they are less cardiotoxic, less lethal in overdose, and produce fewer cognitive impairments. They are not, however, without their own side effects, which include but are not limited to difficulty having orgasms, gastrointestinal issues, and insomnia. It should be noted that anti-depressant medication may not work equally for all people. This approach to treatment often involves experimentation with several medications and dosages, and may be more effective when paired with physical exercise and psychotherapy.

Other biological treatments for people with depression include electroconvulsive therapy (ECT), transcranial magnetic stimulation (TMS), and deep brain stimulation. ECT involves inducing a seizure after a patient takes muscle relaxants and is under general anesthesia. ECT is viable treatment for patients with severe depression or who show resistance to antidepressants although the mechanisms through which it

works remain unknown. A common side effect is confusion and memory loss, usually short-term (Schulze-Rauschenbach, Harms, Schlaepfer, Maier, Falkai, & Wagner, **2005**). Repetitive TMS is a noninvasive technique administered while a patient is awake. Brief pulsating magnetic fields are delivered to the cortex, inducing electrical activity. TMS has fewer side effects than ECT (**Schulze-Rauschenbach et al., 2005**), and while outcome studies are mixed, there is evidence that TMS is a promising treatment for patients with MDD who have shown resistance to other treatments (**Rosa et al., 2006**). Most recently, deep brain stimulation is being examined as a treatment option for patients who did not respond to more traditional treatments like those already described. Deep brain stimulation involves implanting an electrode in the brain. The electrode is connected to an implanted neurostimulator, which electrically stimulates that particular brain region. Although there is some evidence of its effectiveness (**Mayberg et al., 2005**), additional research is needed.

Several psychosocial treatments have received strong empirical support, meaning that independent investigations have achieved similarly positive results—a high threshold for examining treatment outcomes. These treatments include but are not limited to behavior therapy, cognitive therapy, and interpersonal therapy. Behavior therapies focus on increasing the frequency and quality of experiences that are pleasant or help the patient achieve mastery. Cognitive therapies primarily focus on helping patients identify and change distorted automatic thoughts and assumptions (e.g., **Beck, 1967**). Cognitive-behavioral therapies are based on the rationale that thoughts, behaviors, and emotions affect and are affected by each other. Interpersonal Therapy for Depression focuses largely on improving interpersonal relationships by targeting problem areas, specifically unresolved grief, interpersonal role disputes, role transitions, and interpersonal deficits. Finally, there is also some support for the effectiveness of Short-Term

Psychodynamic Therapy for Depression (**Leichsenring, 2001**). The short-term treatment focuses on a limited number of important issues, and the therapist tends to be more actively involved than in more traditional psychodynamic therapy.

Bipolar Disorders

Patients with BD are typically treated with pharmacotherapy. Antidepressants such as SSRIs and SNRIs are the primary choice of treatment for depression, whereas for BD, lithium is the first line treatment choice. This is because SSRIs and SNRIs have the potential to induce mania or hypomania in patients with BD. Lithium acts on several neurotransmitter systems in the brain through complex mechanisms, including reduction of excitatory (dopamine and glutamate) neurotransmission, and increasing of inhibitory (GABA) neurotransmission (**Lenox & Hahn, 2000**). Lithium has strong efficacy for the treatment of BD (Geddes, Burgess, Hawton, Jamison, & Goodwin, **2004**). However, a number of side effects can make lithium treatment difficult for patients to tolerate. Side effects include impaired cognitive function (**Wingo, Wingo, Harvey, & Baldessarini, 2009**), as well as physical symptoms such as nausea, tremor, weight gain, and fatigue (**Dunner, 2000**). Some of these side effects can improve with continued use; however, medication noncompliance remains an ongoing concern in the treatment of patients with BD. Anticonvulsant medications (e.g., carbamazepine, valproate) are also commonly used to treat patients with BD, either alone or in conjunction with lithium.

There are several adjunctive treatment options for people with BD. Interpersonal and social rhythm therapy (IPSRT; **Frank et al., 1994**) is a psychosocial intervention focused on addressing the mechanism of action posited in social *zeitgeber* theory to predispose patients who have BD to relapse, namely sleep disruption. A growing body of literature

provides support for the central role of sleep dysregulation in BD (**Harvey, 2008**). Consistent with this literature, IPSRT aims to increase rhythmicity of patients' lives and encourage vigilance in maintaining a stable rhythm. The therapist and patient work to develop and maintain a healthy balance of activity and stimulation such that the patient does not become overly active (e.g., by taking on too many projects) or inactive (e.g., by avoiding social contact). The efficacy of IPSRT has been demonstrated in that patients who received this treatment show reduced risk of episode recurrence and are more likely to remain well (**Frank et al., 2005**).

Conclusion

Everyone feels down or euphoric from time to time. For some people, these feelings can last for long periods of time and can also co-occur with other symptoms that, in combination, interfere with their everyday lives. When people experience an MDE or a manic episode, they see the world differently. During an MDE, people often feel hopeless about the future, and may even experience suicidal thoughts. During a manic episode, people often behave in ways that are risky or place them in danger. They may spend money excessively or have unprotected sex, often expressing deep shame over these decisions after the episode. MDD and BD cause significant problems for people at school, at work, and in their relationships and affect people regardless of gender, age, nationality, race, religion, or sexual orientation. If you or someone you know is suffering from a mood disorder, it is important to seek help. Effective treatments are available and continually improving. If you have an interest in mood disorders, there are many ways to contribute to their understanding, prevention, and treatment, whether by engaging in research or clinical work.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Anhedonia

Loss of interest or pleasure in activities one previously found enjoyable or rewarding.

Attributional style

The tendency by which a person infers the cause or meaning of behaviors or events.

Chronic stress

Discrete or related problematic events and conditions which persist over time and result in prolonged activation of the biological and/or psychological stress response (e.g., unemployment, ongoing health difficulties, marital discord).

Early adversity

Single or multiple acute or chronic stressful events, which may be biological or psychological in nature (e.g., poverty, abuse, childhood illness or injury), occurring during childhood and resulting in a biological and/or psychological stress response.

Grandiosity

Inflated self-esteem or an exaggerated sense of self-importance and self-worth (e.g., believing one has special powers or superior abilities).

Hypersomnia

Excessive daytime sleepiness, including difficulty staying awake or napping, or prolonged sleep episodes.

Psychomotor agitation

Increased motor activity associated with restlessness, including physical actions (e.g., fidgeting, pacing, feet tapping, handwringing).

Psychomotor retardation

A slowing of physical activities in which routine activities (e.g., eating, brushing teeth) are performed in an unusually slow manner.

Social zeitgeber

Zeitgeber is German for “time giver.” Social zeitgebers are environmental cues, such as meal times and interactions with other people, that entrain biological rhythms and thus sleep-wake cycle regularity.

Socioeconomic status (SES)

A person’s economic and social position based on income, education, and occupation.

Suicidal ideation

Recurring thoughts about suicide, including considering or planning for suicide, or preoccupation with suicide.

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57. Schizophrenia Spectrum Disorders

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This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

Schizophrenia and the other psychotic disorders are some of the most impairing forms of psychopathology, frequently associated with a profound negative effect on the individual's educational, occupational, and social function. Sadly, these disorders often manifest right at time of the transition from adolescence to adulthood, just as young people should be evolving into independent young adults. The spectrum of psychotic disorders includes schizophrenia, schizoaffective disorder, delusional disorder, schizotypal personality disorder, schizophreniform disorder, brief psychotic disorder, as well as psychosis associated with substance use or medical conditions. In this module, we summarize the primary clinical features of these disorders, describe the known cognitive and neurobiological changes associated with schizophrenia, describe potential risk factors and/or causes for the development of schizophrenia, and describe currently available treatments for schizophrenia.

Learning Objectives

- Describe the signs and symptoms of schizophrenia and related psychotic disorders.
- Describe the most well-replicated cognitive and neurobiological changes associated with schizophrenia.
- Describe the potential risk factors for the development of schizophrenia.
- Describe the controversies associated with “clinical high risk” approaches to identifying individuals at risk for the development of schizophrenia.
- Describe the treatments that work for some of the symptoms of schizophrenia.

The phenomenology of schizophrenia and related psychotic disorders

Most of you have probably had the experience of walking down the street in a city and seeing a person you thought was acting in a manner not typical. They may have been dressed in an unusual way, perhaps disheveled or wearing an unusual collection of clothes, makeup, or jewelry that did not seem to fit any particular group or subculture. They may have been talking to themselves or yelling at someone you could not see. If you tried to speak to them, they may have been difficult to follow or understand, or they may have acted paranoid or started telling a bizarre story about the people who were plotting against them. If so, chances are that you have encountered an individual with schizophrenia or another type of psychotic disorder. If you have watched the movie *A Beautiful Mind* or *The Fisher King*, you have also seen a portrayal of someone thought to have schizophrenia. Sadly, a few of the individuals who have committed some of the recently highly

publicized mass murders may have had schizophrenia. It is important to note that most people who commit such crimes do not have schizophrenia. It is also likely that you have met people with schizophrenia without ever knowing it, as they may not share this information, may not display behaviours that are considered as atypical, and they may have effective supports in place. There is significant stigma around schizophrenia, and as these examples begin to illustrate, psychotic disorders involve many different types of symptoms, including delusions, hallucinations, disorganized speech and behavior, abnormal motor behavior (including **catatonia**). They can also include negative symptoms such as **anhedonia/ amotivation** and blunted affect/reduced speech. Further, psychotic disorders including schizophrenia can be overrepresented and misrepresented in the media.

It's important to have a shared understanding of symptoms associated with schizophrenia.

Delusions are false beliefs that are often fixed, hard to change even when the person is presented with conflicting information, and are often culturally influenced in their content (e.g. delusions may involve false beliefs about important figures in a person's culture such as political leaders, popular culture icons, key religious figures, or famous athletes). They can be terrifying for the person, who may remain convinced that they are true even when loved ones and friends present them with clear information that they cannot be true. There are many different types or themes to delusions.



Under Surveillance: Abstract groups like the police or the government are commonly the focus of a person with schizophrenia's persecutory delusions. [Image: Thomas Hawk, <https://goo.gl/qsrqiR>, CC BY-NC 2.0, <https://goo.gl/VnKlK8>]

The most common delusions are persecutory and involve the belief that individuals or groups are trying to hurt, harm, or plot against the person in some way. These can be people that the person knows (people at work, the neighbors, family members), or more abstract groups (the FBI, the CIA, aliens, etc.). Other types of delusions include grandiose delusions, where the person believes that they have some special power or ability (e.g., I am the

new Buddha, I am a rock star); referential delusions, where the person believes that events or objects in the environment have special meaning for them (e.g., that song on the radio is being played *specifically* for me); or other types of delusions where the person may believe that others are controlling their thoughts and actions, their thoughts are being broadcast aloud, or that others can read their mind (or they can read other people's minds).

When you see a person on the street talking to themselves or shouting at other people, they are experiencing **hallucinations**. These are perceptual experiences that occur even when there is no stimulus in the outside world generating the experiences. They can be auditory, visual, olfactory (smell), gustatory (taste), or somatic (touch). The most common hallucinations in psychosis (at least in adults) are auditory, and can involve one or more voices talking about the person, commenting on the person's behavior, or giving them orders. The content of the

hallucinations is frequently negative (“you are a loser,” “that drawing is stupid,” “you should go kill yourself”) and can be the voice of someone the person knows or a complete stranger.

Talking to someone with schizophrenia is sometimes difficult, as their speech may be difficult to follow, either because their answers do not clearly flow from your questions, or because one sentence does not logically follow from another. This is referred to as **disorganized speech**, and it can be present even when the person is writing.

Disorganized behavior can include odd dress, odd makeup (e.g., lipstick outlining a mouth for 1 inch), or unusual rituals (e.g., repetitive hand gestures). Abnormal motor behavior can include catatonia, which refers to a variety of behaviors that seem to reflect a reduction in responsiveness to the external environment. This can include holding unusual postures for long periods of time, failing to respond to verbal or motor prompts from another person, or excessive and seemingly purposeless motor activity.

Some of the most debilitating symptoms of schizophrenia are difficult for others to see. These include what people refer to as “negative symptoms” or the absence of certain things we typically expect most people to have. For example, anhedonia or amotivation reflect a lack of apparent interest in or drive to engage in social or recreational activities. These symptoms can manifest as a great amount of time spent in physical immobility. Importantly, anhedonia and amotivation do not



A painting by Craig Finn, who is diagnosed with schizophrenia, depicting hallucinations. The painting is titled “Artistic view of how the world feels like with schizophrenia”. [Image: Craig Finn, <https://goo.gl/A3fyva>, CC0 1.0, <https://goo.gl/iRMek3>]

seem to reflect a lack of enjoyment in pleasurable activities or events (**Cohen & Minor, 2010; Kring & Moran, 2008; Llerena, Strauss, & Cohen, 2012**) but rather a reduced drive or ability to take the steps necessary to obtain the potentially positive outcomes (**Barch & Dowd, 2010**). **Flat affect** and reduced speech (**alogia**) reflect a lack of showing emotions through facial expressions, gestures, and speech intonation, as well as a reduced amount of speech and increased pause frequency and duration.

In many ways, the types of symptoms associated with psychosis are the most difficult for us to understand, as they may seem far outside the range of our normal experiences. Unlike depression or anxiety, many of us may not have had experiences that we think of as on the same continuum as psychosis. However, just like many of the other forms of **psychopathology** described in this book, the types of psychotic symptoms that characterize disorders like schizophrenia are on a continuum with “normal” mental experiences. For example, work by Jim van Os in the Netherlands has shown that a surprisingly large percentage of the general population (10%+) experience psychotic-like symptoms, though many fewer have multiple experiences and most will not continue to experience these symptoms in the long run (**Verdoux & van Os, 2002**). Similarly, work in a general population of adolescents and young adults in Kenya has also shown that a relatively high percentage of individuals experience one or more psychotic-like experiences (~19%) at some point in their lives (**Mamah et al., 2012; Ndeti et al., 2012**), though again most will not go on to develop a full-blown psychotic disorder.

Schizophrenia is the primary disorder that comes to mind when we discuss “psychotic” disorders (see Table 1 for **diagnostic criteria**), though there are a number of other disorders that share one or more features with schizophrenia.

In the remainder of this module, we will use the terms “psychosis” and “schizophrenia” somewhat interchangeably, given that most of the research has focused on schizophrenia. In addition to schizophrenia (see Table 1), other psychotic disorders include schizophreniform disorder (a briefer version of schizophrenia), schizoaffective disorder (a mixture of psychosis and depression/mania symptoms), delusional disorder (the experience of only delusions), and brief psychotic disorder (psychotic symptoms that last only a few days or weeks).

Schizophrenia (Lifetime prevalence about 0.3% to 0.7% [APA, 2013])
<ul style="list-style-type: none"> • Two or more of the following for at least 1 month: hallucinations, delusions, disorganized speech, grossly disorganized or catatonic behavior, negative symptoms. • Impairment in one or more areas of function (social, occupational, educational self-care) for a significant period of time since the onset of the illness. • Continuous signs of the illness for at least 6 months (this can include prodromal or residual symptoms, which are attenuated forms of the symptoms described above).
Schizophreniform Disorder (Lifetime prevalence similar to Schizophrenia [APA, 2013])
<ul style="list-style-type: none"> • The same symptoms of schizophrenia described above that are present for at least 1 month but less than 6 months.
Schizoaffective Disorder (Lifetime prevalence about 0.3% [APA, 2013])
<ul style="list-style-type: none"> • A period of illness where the person has both the psychotic symptoms necessary to meet criteria for schizophrenia and either a major depression or manic episode. • The person experiences either delusions or hallucinations for at least 2 weeks when they are not having a depressive or manic episode. • The symptoms that meet criteria for depressive or manic episodes are present for over half of the illness duration.
Delusional Disorder (Lifetime prevalence about 0.2% [APA, 2013])
<ul style="list-style-type: none"> • The presence of at least one delusion for at least a month. • The person has never met criteria for schizophrenia. • The person's function is not impaired outside the specific impact of the delusion. • The duration of any depressive or manic episodes have been brief relative to the duration of the delusion(s).
Brief Psychotic Disorder (Lifetime prevalence unclear [APA, 2013])
<ul style="list-style-type: none"> • One or more of the following symptoms present for at least 1 day but less than 1 month: delusions, hallucinations, disorganized speech, grossly disorganized or catatonic behavior.
Attenuated Psychotic Disorder (In Section III of the [APA, 2013]-V, Lifetime presence unclear [APA, 2013])
<ul style="list-style-type: none"> • One or more of the following symptoms in an “attenuated” form: delusions, hallucinations, or disorganized speech. • The symptoms must have occurred at least once a week for the past month and must have started or gotten worse in the past year. • The symptoms must be severe enough to distress or disable the individual or to suggest to others that the person needs clinical help. • The person has never met the diagnostic criteria for a psychotic disorder, and the symptoms are not better attributed to another disorder, to substance use, or to a medical condition.

Table 1: Types of Psychotic Disorders (Simplified from the Diagnostic and Statistical Manual – 5th Edition (DSM-5) (APA, 2013)

The Cognitive Neuroscience of Schizophrenia

As described above, when we think of the core symptoms of psychotic disorders such as schizophrenia, we think of people who hear voices, see visions, and have false beliefs about reality (i.e., delusions). However, problems in cognitive function are also a critical aspect of psychotic disorders and of schizophrenia in particular. This emphasis on cognition in schizophrenia is in part due to the growing body of research suggesting that cognitive problems in schizophrenia are a major source of disability and loss of **functional capacity** (Green, 2006; Nuechterlein et al., 2011). The cognitive deficits that are present in schizophrenia are widespread and can include problems with **episodic memory** (the ability to learn and retrieve new information or episodes in one's life), **working memory** (the ability to maintain information over a short period of time, such as 30 seconds), and other tasks that require one to "control" or regulate one's behavior (Barch & Ceaser, 2012; Bora, Yucel, & Pantelis, 2009a; Fioravanti, Carlone, Vitale, Cinti, & Clare, 2005; Forbes, Carrick, McIntosh, & Lawrie, 2009; Mesholam-Gately, Giuliano, Goff, Faraone, & Seidman, 2009). Individuals with schizophrenia also have difficulty with what is referred to as "**processing speed**" and are frequently slower than healthy individuals on almost all tasks. Importantly, these cognitive deficits are present prior to the onset of the illness (Fusar-Poli et al., 2007) and are also present, albeit in a milder form, in the first-degree relatives of people with schizophrenia (Snitz, Macdonald, & Carter, 2006). This suggests that cognitive impairments in schizophrenia reflect part of the risk for the development of psychosis, rather than being an outcome of developing psychosis. Further, people with schizophrenia who have more severe cognitive problems also tend to have more severe negative symptoms and more

disorganized speech and behavior (Barch, Carter, & Cohen, **2003**; Barch et al., **1999**; Dominguez Mde, Viechtbauer, Simons, van Os, & Krabbendam, **2009**; Ventura, Helleman, Thames, Koellner, & Nuechterlein, **2009**; Ventura, Thames, Wood, Guzik, & Helleman, **2010**). In addition, people with more cognitive problems have worse function in everyday life (Bowie et al., **2008**; Bowie, Reichenberg, Patterson, Heaton, & Harvey, **2006**; Fett et al., **2011**).



Some with schizophrenia suffer from difficulty with social cognition. They may not be able to detect the meaning of facial expressions or other subtle cues that most other people rely on to navigate the social world. [Image: Ralph Buckley, <https://goo.gl/KuBzsD>, CC BY-SA 2.0, <https://goo.gl/i4GXf5>]

Some people with schizophrenia also show deficits in what is referred to as social cognition, though it is not clear whether such problems are separate from the cognitive problems described above or the result of them (Hoe, Nakagami, Green, & Brekke, **2012**; Kerr & Neale, **1993**; van Hooren et al., **2008**). This includes problems with the recognition of emotional expressions on the faces of other individuals (Kohler, Walker, Martin, Healey, & Moberg, **2010**) and problems

inferring the intentions of other people (theory of mind) (Bora, Yucel, & Pantelis, **2009b**). Individuals with schizophrenia who have more problems with social cognition also tend to have more negative and disorganized symptoms (Ventura, Wood, & Helleman, **2011**), as well as worse community function (Fett et al., **2011**).

The advent of neuroimaging techniques such as structural and functional **magnetic resonance imaging** and **positron**

emission tomography opened up the ability to try to understand the brain mechanisms of the symptoms of schizophrenia as well as the cognitive impairments found in psychosis. For example, a number of studies have suggested that delusions in psychosis may be associated with problems in “salience” detection mechanisms supported by the ventral striatum (**Jensen & Kapur, 2009; Jensen et al., 2008; Kapur, 2003; Kapur, Mizrahi, & Li, 2005; Murray et al., 2008**) and the anterior prefrontal cortex (**Corlett et al., 2006; Corlett, Honey, & Fletcher, 2007; Corlett, Murray, et al., 2007a, 2007b**). These are regions of the brain that normally increase their activity when something important (aka “salient”) happens in the environment. If these brain regions misfire, it may lead individuals with psychosis to mistakenly attribute importance to irrelevant or unconnected events. Further, there is good evidence that problems in working memory and cognitive control in schizophrenia are related to problems in the function of a region of the brain called the dorsolateral prefrontal cortex (DLPFC) (**Minzenberg, Laird, Thelen, Carter, & Glahn, 2009; Ragland et al., 2009**). These problems include changes in how the DLPFC works when people are doing working-memory or cognitive-control tasks, and problems with how this brain region is connected to other brain regions important for working memory and cognitive control, including the posterior parietal cortex (e.g., **Karlsgodt et al., 2008; J. J. Kim et al., 2003; Schlosser et al., 2003**), the anterior cingulate (**Repovs & Barch, 2012**), and temporal cortex (e.g., **Fletcher et al., 1995; Meyer-Lindenberg et al., 2001**). In terms of understanding episodic memory problems in schizophrenia, many researchers have focused on medial temporal lobe deficits, with a specific focus on the hippocampus (e.g., **Heckers & Konradi, 2010**). This is because there is much data from humans and animals showing that the hippocampus is important for the creation of new memories (**Squire, 1992**). However, it has become increasingly clear that

problems with the DLPFC also make important contributions to episodic memory deficits in schizophrenia (**Ragland et al., 2009**), probably because this part of the brain is important for controlling our use of memory.

In addition to problems with regions such as the DLPFC and medial temporal lobes in schizophrenia described above, magnitude resonance neuroimaging studies have also identified changes in cellular architecture, white matter connectivity, and gray matter volume in a variety of regions that include the prefrontal and temporal cortices (**Bora et al., 2011**). People with schizophrenia also show reduced overall brain volume, and reductions in brain volume as people get older may be larger in those with schizophrenia than in healthy people (**Olabi et al., 2011**). Taking antipsychotic medications or taking drugs such as marijuana, alcohol, and tobacco may cause some of these structural changes. However, these structural changes are not completely explained by medications or substance use alone. Further, both functional and structural brain changes are seen, again to a milder degree, in the first-degree relatives of people with schizophrenia (**Boos, Aleman, Cahn, Pol, & Kahn, 2007; Brans et al., 2008; Fusar-Poli et al., 2007; MacDonald, Thermenos, Barch, & Seidman, 2009**). This again suggests that that neural changes associated with schizophrenia are related to a genetic risk for this illness.

Risk Factors for Developing Schizophrenia

It is clear that there are important genetic contributions to the likelihood that someone will develop schizophrenia, with consistent evidence from family, twin, and adoption studies. (**Sullivan, Kendler, & Neale, 2003**). However, there is no “schizophrenia gene” and it is likely that the genetic risk for

schizophrenia reflects the summation of many different genes that each contribute something to the likelihood of developing psychosis (**Gottesman & Shields, 1967; Owen, Craddock, & O'Donovan, 2010**). Further, schizophrenia is a very heterogeneous disorder, which means that two different people with “schizophrenia” may each have very different symptoms (e.g., one has hallucinations and delusions, the other has disorganized speech and negative symptoms). This makes it even more challenging to identify specific genes associated with risk for psychosis. Importantly, many studies also now suggest that at least some of the genes potentially associated with schizophrenia are also associated with other mental health conditions, including bipolar disorder, depression, and autism (**Gejman, Sanders, & Kendler, 2011; Y. Kim, Zerwas, Trace, & Sullivan, 2011; Owen et al., 2010; Rutter, Kim-Cohen, & Maughan, 2006**).



There are a number of genetic and environmental risk factors associated with higher likelihood of developing schizophrenia including older fathers, complications during pregnancy/delivery, family history of schizophrenia, and growing up in an urban environment. [Image: CCO Public Domain]

There are also a number of environmental factors that are associated with an increased risk of developing schizophrenia. For example, problems during pregnancy such as increased stress, infection, malnutrition, and/or diabetes have been associated with increased risk of schizophrenia. In addition, complications that occur at the time of birth and which cause hypoxia (lack of oxygen) are also associated with an increased risk for developing schizophrenia (**M. Cannon, Jones, & Murray, 2002; Miller et al., 2011**).

Children born to older fathers are also at a somewhat increased risk of developing schizophrenia. Further, using cannabis increases risk for developing psychosis, especially if you have other risk factors (Casadio, Fernandes, Murray, & Di Forti, **2011**; Luzi, Morrison, Powell, di Forti, & Murray, **2008**). The likelihood of developing schizophrenia is also higher for kids who grow up in urban settings (**March et al., 2008**) and for some minority ethnic groups (Bourque, van der Ven, & Malla, **2011**). Both of these factors may reflect higher social and environmental stress in these settings. Unfortunately, none of these risk factors is specific enough to be particularly useful in a clinical setting, and most people with these “risk” factors do not develop schizophrenia. However, together they are beginning to give us clues as the **neurodevelopmental** factors that may lead someone to be at an increased risk for developing this disease.

An important research area on risk for psychosis has been work with individuals who may be at “clinical high risk.” These are individuals who are showing attenuated (milder) symptoms of psychosis that have developed recently and who are experiencing some distress or disability associated with these symptoms. When people with these types of symptoms are followed over time, about 35% of them develop a psychotic disorder (**T. D. Cannon et al., 2008**), most frequently schizophrenia (**Fusar-Poli, McGuire, & Borgwardt, 2012**). In order to identify these individuals, a new category of diagnosis, called “Attenuated Psychotic Syndrome,” was added to Section III (the section for disorders in need of further study) of the DSM-5 (see Table 1 for symptoms) (**APA, 2013**). However, adding this diagnostic category to the DSM-5 created a good deal of controversy (**Batstra & Frances, 2012; Fusar-Poli & Yung, 2012**). Many scientists and clinicians have been worried that including “risk” states in the DSM-5 would create mental disorders where none exist, that these individuals are often already seeking

treatment for other problems, and that it is not clear that we have good treatments to stop these individuals from developing to psychosis. However, the counterarguments have been that there is evidence that individuals with high-risk symptoms develop psychosis at a much higher rate than individuals with other types of psychiatric symptoms, and that the inclusion of Attenuated Psychotic Syndrome in Section III will spur important research that might have clinical benefits. Further, there is some evidence that non-invasive treatments such as omega-3 fatty acids and intensive family intervention may help reduce the development of full-blown psychosis (Preti & Cella, 2010) in people who have high-risk symptoms.

Treatment of Schizophrenia

The currently available treatments for schizophrenia leave much to be desired, and the search for more effective treatments for both the psychotic symptoms of schizophrenia (e.g., hallucinations and delusions) as well as cognitive deficits and negative symptoms is a highly active area of research. The first line of treatment for schizophrenia and other psychotic disorders is the use of antipsychotic medications. There are two primary types of antipsychotic medications, referred to as “typical” and “atypical.” The fact that “typical” antipsychotics helped some symptoms of schizophrenia was discovered serendipitously more than 60 years ago (Carpenter & Davis, 2012; Lopez-Munoz et al., 2005). These are drugs that all share a common feature of being a strong block of the D2 type **dopamine** receptor. Although these drugs can help reduce hallucinations, delusions, and disorganized speech, they do little to improve cognitive deficits or negative symptoms and can be associated with distressing motor side effects. The newer generation of antipsychotics is referred to as “atypical” antipsychotics. These drugs have more mixed

mechanisms of action in terms of the receptor types that they influence, though most of them also influence D2 receptors. These newer antipsychotics are not necessarily more helpful for schizophrenia but have fewer motor side effects. However, many of the atypical antipsychotics are associated with side effects referred to as the “metabolic syndrome,” which includes weight gain and increased risk for cardiovascular illness, Type-2 diabetes, and mortality (**Lieberman et al., 2005**).

The evidence that cognitive deficits also contribute to functional impairment in schizophrenia has led to an increased search for treatments that might enhance cognitive function in schizophrenia. Unfortunately, as of yet, there are no pharmacological treatments that work consistently to improve cognition in schizophrenia, though many new types of drugs are currently under exploration. However, there is a type of psychological intervention, referred to as cognitive remediation, which has shown some evidence of helping cognition and function in schizophrenia. In particular, a version of this treatment called Cognitive Enhancement Therapy (CET) has been shown to improve cognition, functional outcome, social cognition, and to protect against gray matter loss (**Eack et al., 2009**; Eack, Greenwald, Hogarty, & Keshavan, **2010**; **Eack et al., 2010**; **Eack, Pogue-Geile, Greenwald, Hogarty, & Keshavan, 2010**; **Hogarty, Greenwald, & Eack, 2006**) in young individuals with schizophrenia. The development of new treatments such as Cognitive Enhancement Therapy provides some hope that we will be able to develop new and better approaches to improving the lives of individuals with this serious mental health condition and potentially even prevent it some day.

Check Your Knowledge

To help you with your studying, we’ve included some practice

questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Alogia

A reduction in the amount of speech and/or increased pausing before the initiation of speech.

Anhedonia/amotivation

A reduction in the drive or ability to take the steps or engage in actions necessary to obtain the potentially positive outcome.

Catatonia

Behaviors that seem to reflect a reduction in responsiveness to the external environment. This can include holding unusual postures for long periods of time, failing to respond to verbal or motor prompts from another person, or excessive and seemingly purposeless motor activity.

Delusions

False beliefs that are often fixed, hard to change even in the presence of conflicting information, and often culturally influenced in their content.

Diagnostic criteria

The specific criteria used to determine whether an individual has a specific type of psychiatric disorder.

Commonly used diagnostic criteria are included in the Diagnostic and Statistical Manual of Mental Disorder, 5th Edition (DSM-5) and the Internal Classification of Disorders, Version 9 (ICD-9).

Disorganized behavior

Behavior or dress that is outside the norm for almost all subcultures. This would include odd dress, odd makeup (e.g., lipstick outlining a mouth for 1 inch), or unusual rituals (e.g., repetitive hand gestures).

Disorganized speech

Speech that is difficult to follow, either because answers do not clearly follow questions or because one sentence does not logically follow from another.

Dopamine

A neurotransmitter in the brain that is thought to play an important role in regulating the function of other neurotransmitters.

Episodic memory

The ability to learn and retrieve new information or episodes in one's life.

Flat affect

A reduction in the display of emotions through facial expressions, gestures, and speech intonation.

Functional capacity

The ability to engage in self-care (cook, clean, bathe), work, attend school, and/or engage in social relationships.

Hallucinations

Perceptual experiences that occur even when there is no stimulus in the outside world generating the experiences. They can be auditory, visual, olfactory (smell), gustatory (taste), or somatic (touch).

Magnetic resonance imaging

A set of techniques that uses strong magnets to measure either the structure of the brain (e.g., gray matter and white matter) or how the brain functions when a person performs cognitive tasks (e.g., working memory or episodic memory) or other types of tasks.

Neurodevelopmental

Processes that influence how the brain develops either in utero or as the child is growing up.

Positron emission tomography

A technique that uses radio-labelled ligands to measure the distribution of different neurotransmitter receptors in the brain or to measure how much of a certain type of neurotransmitter is released when a person is given a specific type of drug or does a particularly cognitive task.

Processing speed

The speed with which an individual can perceive auditory or visual information and respond to it.

Psychopathology

Illnesses or disorders that involve psychological or psychiatric symptoms.

Working memory

The ability to maintain information over a short period of time, such as 30 seconds or less.

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PSYC 100 XXI

PSYCHOPATHOLOGY AND THERAPEUTIC ORIENTATIONS

58. Personality Disorders

Original chapter by Cristina Crego and Thomas Widiger adapted by the Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below. We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link:
<https://sass.queensu.ca/psyc100/>

The purpose of this module is to define what is meant by a personality disorder, identify the five domains of general personality (i.e., neuroticism, extraversion, openness, agreeableness, and conscientiousness), identify the six personality disorders proposed for retention in the 5th edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (i.e., borderline, antisocial, schizotypal, avoidant, obsessive-compulsive, and narcissistic), summarize the etiology for antisocial and borderline personality disorder, and identify the treatment for borderline personality disorder (i.e., dialectical behavior therapy and mentalization therapy).

Learning Objectives

- Define what is meant by a personality disorder.

- Identify the five domains of general personality.
- Identify the six personality disorders proposed for retention in DSM-5.
- Summarize the etiology for antisocial and borderline personality disorder.
- Identify the treatment for borderline personality disorder.

Introduction

Everybody has their own unique **personality**; that is, their characteristic manner of thinking, feeling, behaving, and relating to others (**John, Robins, & Pervin, 2008**). Some people are typically introverted, quiet, and withdrawn; whereas others are more extraverted, active, and outgoing. Some individuals are invariably conscientiousness, dutiful, and efficient; whereas others might be characteristically undependable and negligent. Some individuals are consistently anxious, self-conscious, and apprehensive; whereas others are routinely relaxed, self-assured, and unconcerned. Personality traits refer to these characteristic, routine ways of thinking, feeling, and relating to others. There are signs or indicators of these traits in childhood, but they become particularly evident when the person is an adult. Personality traits are integral to each person's sense of self, as they involve what people value, how they think and feel about things, what they like to do, and, basically, what they are like most every day throughout much of their lives.

There are literally hundreds of different personality traits. All of these traits can be organized into the broad dimensions referred to as the **Five-Factor Model** (John, Naumann, & Soto, **2008**). These five broad domains are inclusive; there does not appear to be any traits of personality that lie outside of the Five-Factor Model. This even applies to traits that you may use to describe yourself. Table I provides illustrative traits for both

poles of the five domains of this model of personality. A number of the traits that you see in this table may describe you. If you can think of some other traits that describe yourself, you should be able to place them somewhere in this table.

<p>Neuroticism (Emotional Instability)</p> <p>Fearful, apprehensive, angry, bitter, pessimistic, glum, timid, embarrassed, tempted, urgency, helpless, fragile</p>	<p>Emotional Stability</p> <p>relaxed, unconcerned, cool, even-tempered, optimistic, self-assured, glib, shameless, controlled, restrained, clear-thinking, fearless, unflappable</p>
<p>Extraversion</p> <p>cordial, affectionate, attached, sociable, outgoing, dominant, forceful, vigorous, energetic, active, reckless, daring, high-spirited, excitement-seeking</p>	<p>Introversion</p> <p>cold, aloof, indifferent, withdrawn, isolated, unassuming, quiet, resigned, passive, lethargic, cautious, monotonous, dull, placid, anhedonic</p>
<p>Openness (unconventionality)</p> <p>dreamer, unrealistic, imaginative, aberrant, aesthetic, self-aware, eccentric, strange, odd, peculiar, creative, permissive, broad-minded</p>	<p>Closedness (conventionality)</p> <p>practical, concrete, uninvolved, no aesthetic interest, constricted, unaware, alexythymic, routine, predictable, habitual, stubborn, pragmatic, rigid, traditional, inflexible, dogmatic</p>
<p>Agreeableness</p> <p>gullible, naive, trusting, confiding, honest, sacrificial, giving, docile, cooperative, meek, self-effacing, humble, soft, empathetic</p>	<p>Antagonism</p> <p>skeptical, cynical, suspicious, paranoid, cunning, manipulative, deceptive, stingy, selfish, greedy, exploitative, oppositional, combative, aggressive, confident, boastful, arrogant, tough, callous, ruthless</p>

Conscientiousness

perfectionistic, efficient, ordered, methodical, organized, rigid, reliable, dependable, workaholic, ambitious, dogged, devoted, cautious, ruminative, reflective



Disinhibition

lad, negligent, haphazard, disorganized, sloppy, casual, undependable, unethical, aimless, desultory, hedonistic, negligent, hasty, careless, rash

Table I: Illustrative traits for both poles across Five-Factor Model personality dimensions.

DSM-5 Personality Disorders

When personality traits result in significant distress, social impairment, and/or occupational impairment, they are considered to be a personality disorder (American Psychiatric Association, **2013**). The authoritative manual for what constitutes a personality disorder is provided by the American Psychiatric Association's (APA) *Diagnostic and Statistical Manual of Mental Disorders* (DSM), the current version of which is DSM-5 (APA, **2013**). The DSM provides a common language and standard criteria for the classification and diagnosis of mental disorders. This manual is used by clinicians, researchers, health insurance companies, and policymakers. DSM-5 includes 10 **personality disorders**: antisocial, avoidant, borderline, dependent, histrionic, narcissistic, obsessive-compulsive, paranoid, schizoid, and schizotypal. All 10 of these personality disorders will be included in the next edition of the diagnostic manual, DSM-5.

This list of 10 though does not fully cover all of the different ways in which a personality can be maladaptive. DSM-5 also includes a "wastebasket" diagnosis of other specified personality disorder (OSPD) and unspecified personality disorder (UPD). This diagnosis is used when a clinician believes that a patient has a personality disorder but the traits that constitute this disorder are not well covered by one of the 10 existing diagnoses. OSPD and UPD or as they used to be referred to in previous editions – PDNOS (personality disorder not otherwise specified) are often one of the most frequently used diagnoses in clinical practice, suggesting that the current list of 10 is not adequately comprehensive (**Widiger & Trull, 2007**).

Description

Each of the 10 DSM-5 (and DSM-IV-TR) personality disorders is a constellation of maladaptive personality traits, rather than just one particular personality trait (**Lynam & Widiger, 2001**). In this regard, personality disorders are “syndromes.” For example, **avoidant** personality disorder is a pervasive pattern of social inhibition, feelings of inadequacy, and hypersensitivity to negative evaluation (**APA, 2013**), which is a combination of traits from introversion (e.g., socially withdrawn, passive, and cautious) and neuroticism (e.g., self-consciousness, apprehensiveness, anxiousness, and worrisome). **Dependent** personality disorder includes submissiveness, clinging behavior, and fears of separation (**APA, 2013**), for the most part a combination of traits of neuroticism (anxious, uncertain, pessimistic, and helpless) and maladaptive agreeableness (e.g., gullible, guileless, meek, subservient, and self-effacing). **Antisocial** personality disorder is, for the most part, a combination of traits from antagonism (e.g., dishonest, manipulative, exploitative, callous, and merciless) and low conscientiousness (e.g., irresponsible, immoral, lax, hedonistic, and rash). See the 1967 movie, *Bonnie and Clyde*, starring Warren Beatty, for a nice portrayal of someone with antisocial personality disorder.

Some of the DSM-5 personality disorders are confined largely to traits within one of the basic domains of personality. For example, **obsessive-compulsive** personality disorder is largely a disorder of maladaptive conscientiousness, including such traits as workaholism, perfectionism, punctilious, ruminative, and dogged; **schizoid** is confined largely to traits of introversion (e.g., withdrawn, cold, isolated, placid, and



A person with an obsessive compulsive personality disorder may have a hard time relaxing, always feel under pressure, and believe that there isn't enough time to accomplish important tasks. [Image: CC0 Public Domain, <https://goo.gl/m25gce>]

anhedonic); **borderline** personality disorder is largely a disorder of neuroticism, including such traits as emotionally unstable, vulnerable, overwhelmed, rageful, depressive, and self-destructive (watch the 1987 movie, *Fatal Attraction*, starring Glenn Close, for a nice portrayal of this personality disorder); and **histrionic** personality disorder is largely a disorder of maladaptive extraversion, including such traits as attention-seeking, seductiveness, melodramatic emotionality, and strong attachment needs (see the 1951 film adaptation of Tennessee William's play, *Streetcar Named Desire*, starring Vivian Leigh, for a nice portrayal of this personality disorder).

It should be noted though that a complete description of each DSM-5 personality disorder would typically include at least some traits from other domains. For example, antisocial personality disorder (or psychopathy) also includes some traits from low neuroticism (e.g., fearlessness and glib charm) and extraversion (e.g., excitement-seeking and assertiveness);

borderline includes some traits from antagonism (e.g., manipulative and oppositional) and low conscientiousness (e.g., rash); and histrionic includes some traits from antagonism (e.g., vanity) and low conscientiousness (e.g., impressionistic). **Narcissistic** personality disorder includes traits from neuroticism (e.g., reactive anger, reactive shame, and need for admiration), extraversion (e.g., exhibitionism and authoritativeness), antagonism (e.g., arrogance, entitlement, and lack of empathy), and conscientiousness (e.g., acclaim-seeking). **Schizotypal** personality disorder includes traits from neuroticism (e.g., social anxiousness and social discomfort), introversion (e.g., social withdrawal), unconventionality (e.g., odd, eccentric, peculiar, and aberrant ideas), and antagonism (e.g., suspiciousness).

The APA currently conceptualizes personality disorders as qualitatively distinct conditions; distinct from each other and from normal personality functioning. However, included within an appendix to DSM-5 is an alternative view that personality disorders are simply extreme and/or maladaptive variants of normal personality traits, as suggested herein. Nevertheless, many leading personality disorder researchers do not hold this view (e.g., **Gunderson, 2010; Hopwood, 2011; Shedler et al., 2010**). They suggest that there is something qualitatively unique about persons suffering from a personality disorder, usually understood as a form of pathology in sense of self and interpersonal relatedness that is considered to be distinct from personality traits (**APA, 2012; Skodol, 2012**). For example, it has been suggested that antisocial personality disorder includes impairments in identity (e.g., egocentrism), self-direction, empathy, and capacity for intimacy, which are said to be different from such traits as arrogance, impulsivity, and callousness (**APA, 2012**).

Validity

It is quite possible that in future revisions of the DSM some of the personality disorders included in DSM-5 and DSM-IV-TR will no longer be included. In fact, for DSM-5 it was originally proposed that four be deleted. The personality disorders that were slated for deletion were histrionic, schizoid, **paranoid**, and dependent (APA, 2012). The rationale for the proposed deletions was in large part because they are said to have less empirical support than the diagnoses that were at the time being retained (Skodol, 2012). There is agreement within the field with regard to the empirical support for the borderline, antisocial, and schizotypal personality disorders (Mullins-Sweat, Bernstein, & Widiger, 2012; Skodol, 2012). However, there is a difference of opinion with respect to the empirical support for the dependent personality disorder (Bornstein, 2012; Livesley, 2011; Miller, Widiger, & Campbell, 2010; Mullins-Sweat et al., 2012).

Little is known about the specific etiology for most of the DSM-5 personality disorders. Because each personality disorder represents a constellation of personality traits, the etiology for the syndrome will involve a complex interaction of an array of different neurobiological vulnerabilities and dispositions with a variety of environmental, psychosocial events. Antisocial personality disorder, for instance, is generally considered to be the result of an interaction of genetic dispositions for low anxiousness, aggressiveness, impulsivity, and/or callousness, with a tough, urban environment, inconsistent parenting, poor parental role modeling, and/or peer support (Hare, Neumann, & Widiger, 2012). Borderline personality disorder is generally considered to be the result of an interaction of a genetic disposition to negative affectivity interacting with a malevolent, abusive, and/or invalidating family environment (Hooley, Cole, & Gironde, 2012).

To the extent that one considers the DSM-5 personality

disorders to be maladaptive variants of general personality structure, as described, for instance, within the Five-Factor Model, there would be a considerable body of research to support the validity for all of the personality disorders, including even the histrionic, schizoid, and paranoid. There is compelling multivariate behavior genetic support with respect to the precise structure of the Five-Factor Model (e.g., **Yamagata et al., 2006**), childhood antecedents (**Caspi, Roberts, & Shiner, 2005**), universality (**Allik, 2005**), temporal stability across the lifespan (**Roberts & DelVecchio, 2000**), ties with brain structure (**DeYoung, Hirsh, Shane, Papademetris, Rajeevan, & Gray, 2010**), and even molecular genetic support for neuroticism (**Widiger, 2009**).

Treatment

Personality disorders are relatively unique because they are often “ego-syntonic,” that is, most people are largely comfortable with their selves, with their characteristic manner of behaving, feeling, and relating to others. As a result, people rarely seek treatment for their antisocial, narcissistic, histrionic, paranoid, and/or schizoid personality disorder. People typically lack insight into the maladaptivity of their personality.



Many people with personality disorders do not seek treatment. Those with borderline personality disorder and avoidant personality disorder are exceptions. High levels of neuroticism and emotional pain may motivate them to seek help. [Image: CCO Public Domain, <https://goo.gl/m25gce>]

One clear exception though is borderline personality disorder (and perhaps as well avoidant personality disorder). Neuroticism is the domain of general personality structure that concerns inherent feelings of emotional pain and suffering, including feelings of distress, anxiety, depression, self-consciousness, helplessness, and vulnerability. Persons who have very high elevations on neuroticism (i.e., persons with borderline personality disorder) experience life as one of pain

and suffering, and they will seek treatment to alleviate this severe emotional distress. People with avoidant personality may also seek treatment for their high levels of neuroticism (anxiousness and self-consciousness) and introversion (social isolation). In contrast, narcissistic individuals will rarely seek treatment to reduce their arrogance; paranoid persons rarely seek treatment to reduce their feelings of suspiciousness; and antisocial people rarely (or at least willfully) seek treatment to reduce their disposition for criminality, aggression, and irresponsibility.

Nevertheless, maladaptive personality traits will be evident in many individuals seeking treatment for other mental disorders, such as anxiety, mood, or substance use. Many of the people with a substance use disorder will have antisocial personality traits; many of the people with mood disorder will have borderline personality traits. The prevalence of personality

disorders within clinical settings is estimated to be well above 50% (**Torgersen, 2012**). As many as 60% of inpatients within some clinical settings are diagnosed with borderline personality disorder (**APA, 2000**). Antisocial personality disorder may be diagnosed in as many as 50% of inmates within a correctional setting (**Hare et al., 2012**). It is estimated that 10% to 15% of the general population meets criteria for at least one of the 10 DSM-IV-TR personality disorders (**Torgersen, 2012**), and quite a few more individuals are likely to have maladaptive personality traits not covered by one of the 10 DSM-5 diagnoses.

The presence of a personality disorder will often have an impact on the treatment of other mental disorders, typically inhibiting or impairing responsivity. Antisocial persons will tend to be irresponsible and negligent; borderline persons can form intensely manipulative attachments to their therapists; paranoid patients will be unduly suspicious and accusatory; narcissistic patients can be dismissive and denigrating; and dependent patients can become overly attached to and feel helpless without their therapists.

It is a misnomer, though, to suggest that personality disorders cannot themselves be treated. Personality disorders are among the most difficult of disorders to treat because they involve well-established behaviors that can be integral to a client's self-image (**Millon, 2011**). Nevertheless, much has been written on the treatment of personality disorder (e.g., **Beck, Freeman, Davis, & Associates, 1990; Gunderson & Gabbard, 2000**), and there is empirical support for clinically and socially meaningful changes in response to psychosocial and pharmacologic treatments (**Perry & Bond, 2000**). The development of an ideal or fully healthy personality structure is unlikely to occur through the course of treatment, but given the considerable social, public health, and personal costs associated with some of the personality disorders, such as the antisocial and borderline, even just moderate adjustments in

personality functioning can represent quite significant and meaningful change.

Nevertheless, manualized and/or empirically validated treatment protocols have been developed for only one personality disorder, borderline (APA, 2001).

Focus Topic: Treatment of Borderline Personality Disorder

Dialectical behavior therapy (Lynch & Cuyper, 2012) and mentalization therapy (Bateman & Fonagy, 2012): Dialectical behavior therapy is a form of cognitive-behavior therapy that draws on principles from Zen Buddhism, dialectical philosophy, and behavioral science. The treatment has four components: individual therapy, group skills training, telephone coaching, and a therapist consultation team, and will typically last a full year. As such, it is a relatively expensive form of treatment, but research has indicated that its benefits far outweighs its costs, both financially and socially

It is unclear why specific and explicit treatment manuals have not been developed for the other personality disorders. This may reflect a regrettable assumption that personality disorders are unresponsive to treatment. It may also reflect the complexity of their treatment. As noted earlier, each DSM-5 disorder is a heterogeneous constellation of maladaptive personality traits. In fact, a person can meet diagnostic criteria for the antisocial, borderline, schizoid, schizotypal, narcissistic, and avoidant personality disorders and yet have only one

diagnostic criterion in common. For example, only five of nine features are necessary for the diagnosis of borderline personality disorder; therefore, two persons can meet criteria for this disorder and yet have only one feature in common. In addition, patients meeting diagnostic criteria for one personality disorder will often meet diagnostic criteria for another. This degree of diagnostic overlap and heterogeneity of membership hinders tremendously any effort to identify a specific etiology, pathology, or treatment for a respective personality disorder as there is so much variation within any particular group of patients sharing the same diagnosis (**Smith & Zapski, 2009**).

Of course, this diagnostic overlap and complexity did not prevent researchers and clinicians from developing dialectical behavior therapy and mentalization therapy. A further reason for the weak progress in treatment development is that, as noted earlier, persons rarely seek treatment for their personality disorder. It would be difficult to obtain a sufficiently large group of people with, for instance, narcissistic or obsessive-compulsive disorder to participate in a treatment outcome study, one receiving the manualized treatment protocol, the other receiving treatment as usual.

Conclusions

It is evident that all individuals have a personality, as indicated by their characteristic way of thinking, feeling, behaving, and relating to others. For some people, these traits result in a considerable degree of distress and/or impairment, constituting a personality disorder. A considerable body of research has accumulated to help understand the etiology, pathology, and/or treatment for some personality disorders (i.e., antisocial, schizotypal, borderline, dependent, and narcissistic),

but not so much for others (e.g., histrionic, schizoid, and paranoid). However, researchers and clinicians are now shifting toward a more dimensional understanding of personality disorders, wherein each is understood as a maladaptive variant of general personality structure, thereby bringing to bear all that is known about general personality functioning to an understanding of these maladaptive variants.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Antisocial

A pervasive pattern of disregard and violation of the rights of others. These behaviors may be aggressive or destructive and may involve breaking laws or rules, deceit or theft.

Avoidant

A pervasive pattern of social inhibition, feelings of inadequacy, and hypersensitivity to negative evaluation.

Borderline

A pervasive pattern of instability of interpersonal relationships, self-image, and affects, and marked impulsivity.

Dependent

A pervasive and excessive need to be taken care of that leads to submissive and clinging behavior and fears of separation.

Five-Factor Model

Five broad domains or dimensions that are used to

describe human personality.

Histrionic

A pervasive pattern of excessive emotionality and attention seeking.

Narcissistic

A pervasive pattern of grandiosity (in fantasy or behavior), need for admiration, and lack of empathy.

Obsessive-compulsive

A pervasive pattern of preoccupation with orderliness, perfectionism, and mental and interpersonal control, at the expense of flexibility, openness, and efficiency.

Paranoid

A pervasive distrust and suspiciousness of others such that their motives are interpreted as malevolent.

Personality

Characteristic, routine ways of thinking, feeling, and relating to others.

Personality disorders

When personality traits result in significant distress, social impairment, and/or occupational impairment.

Schizoid

A pervasive pattern of detachment from social relationships and a restricted range of expression of emotions in interpersonal settings.

Schizotypal

A pervasive pattern of social and interpersonal deficits marked by acute discomfort with, and reduced capacity for, close relationships as well as perceptual distortions and eccentricities of behavior.

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59. Psychopathy

Original chapter by Chris Patrick adapted
by the Queen's University Psychology
Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

Psychopathy (or “psychopathic personality”) is a topic that has long fascinated the public at large as well as scientists and clinical practitioners. However, it has also been subject to considerable confusion and scholarly debate over the years. This module reviews alternative conceptions of psychopathy that have been proposed historically, and reviews major instruments currently in use for the assessment of psychopathic tendencies in clinical and nonclinical samples. An integrative theoretic framework, the Triarchic model, is presented that provides a basis for reconciling differing historic conceptions and assessment approaches. Implications of the model for thinking about causal hypotheses of psychopathy, and for resolving longstanding points of contention in the field, are discussed.

Learning Objectives

- Learn about Cleckley's classic account of psychopathy,

presented in his book *The Mask of Sanity*, along with other historic conceptions.

- Compare and contrast differing inventories currently in use for assessing psychopathy in differing samples (e.g., adults and younger individuals, within clinical-forensic and community settings).
- Become familiar with the Triarchic model of psychopathy and its constituent constructs of boldness, meanness, and disinhibition.
- Learn about alternative theories regarding the causal origins of psychopathy.
- Consider how longstanding matters of debate regarding the nature, definition, and origins of psychopathy can be addressed from the perspective of the Triarchic model.

Introduction



Popular media have developed the character of the psychopath into a popular genre. But often these portrayals – psychopaths as criminal monsters preying on innocent people – are misleading. [Image: CC0 Public Domain, <https://goo.gl/m25gce>]

For many in the public at large, the term “psychopath” conjures up images of ruthless homicidal maniacs and criminal masterminds. This impression is reinforced on an ongoing basis by depictions of psychopathic individuals in popular books and films, such as *No Country for Old Men*, *Silence of the Lambs*, and *Catch Me if You Can*, and by media accounts of high-profile criminals ranging from Charles Manson to Jeffrey Dahmer to Bernie Madoff.

However, the concept of **psychopathy** (“psychopathic personality”) held by experts in the mental health field differs sharply from this common public perception—emphasizing distinct dispositional tendencies as opposed to serious criminal acts of one sort or another. This module reviews historic and contemporary conceptions of psychopathy as a clinical disorder, describes methods for assessing it, and discusses how a new conceptual model can help to address key questions regarding its nature and origins that have long been debated. It will be seen from this review that the topic remains no less fascinating or socially relevant when considered from a clinical–scientific perspective.

Historic Conceptions

Early writers characterized psychopathy as an atypical form of mental illness in which rational faculties appeared normal but everyday behavior and social relationships are markedly disrupted. French physician Philippe Pinel (**1806/1962**) documented cases of what he called *manie sans delire* (“insanity without delirium”), in which dramatic episodes of recklessness and aggression occurred in individuals not suffering from obvious clouding of the mind. German psychiatrist Julius Koch (**1888**) introduced the disease-oriented term *psychopathic* to convey the idea that conditions of this type had a strong constitutional-heritable basis. In his seminal book *The Mask of Sanity*, which focused on patients committed for hospital treatment, American psychiatrist Hervey Cleckley (**1941/1976**) described psychopathy as a deep-rooted emotional pathology concealed by an outward appearance of good mental health. In contrast with other psychiatric patients, psychopathic individuals present as confident, sociable, and well adjusted. However, their underlying disorder reveals itself over time through their

actions and attitudes. To facilitate identification of psychopathic individuals in clinical settings, Cleckley provided 16 diagnostic criteria distilled from his clinical case summaries, encompassing indicators of apparent psychological stability (e.g., charm and intelligence, absence of nervousness) along with symptoms of behavioral deviancy (e.g., irresponsibility, failure to plan) and impaired affect and social connectedness (e.g., absence of remorse, deceptiveness, inability to love).

Notably, Cleckley did not characterize psychopathic patients as inherently cruel, violent, or dangerous. Although some engaged in repetitive violent acts, more often the harm they caused was nonphysical and the product of impulsive self-centeredness as opposed to viciousness.

Indeed, Cleckley's case histories included examples of "successful psychopaths" who ascended to careers as professors, medical doctors, or businessmen, along with examples of more aimless dysfunctional types. In



Hervey Cleckley, the man who devised the original tests for psychopathy, asserted that some psychopaths may appear as well-adjusted, successful people who maintain respectable careers in fields like business and medicine. [Image: Jonna Fransa, CC0 Public Domain, <https://goo.gl/m25gce>]

contrast with this, other writers from Cleckley's time who were concerned with criminal expressions of psychopathy placed greater emphasis on symptoms of emotional coldness, aggression, and predatory victimization. For example, McCord and McCord (1964) described the condition in more generally pathologic terms, highlighting "guiltlessness" (lack of remorse) and "lovelessness" (lack of attachment capacity) as central defining features.

Cleckley's conception served as a referent for the diagnosis of psychopathy in the first two editions of the official American psychiatric nosology, the *Diagnostic and Statistical Manual of Mental Disorders* (DSM). However, a dramatic shift occurred in the third edition of the DSM, with the introduction of behaviorally oriented symptom definitions for most disorders to address longstanding problems of reliability. The Cleckley-oriented conception of psychopathy in prior editions was replaced by **antisocial personality disorder** (ASPD), defined by specific indicants of behavioral deviancy in childhood (e.g., fighting, lying, stealing, truancy) continuing into adulthood (manifested as repeated rulebreaking, impulsiveness, irresponsibility, aggressiveness, etc.). Concerns with this new conception were expressed by psychopathy experts, who noted that ASPD provided limited coverage of interpersonal-affective symptoms considered essential to psychopathy (e.g., charm, deceitfulness, selfishness, shallow affect; **Hare, 1983**). Nonetheless, ASPD was retained in much the same form in the fourth edition of the DSM (DSM-IV; American Psychiatric Association [**APA, 2000**]), and remained unchanged in the fifth edition of the DSM (**American Psychiatric Association, 2013**). That said, the DSM-5 does include a new, dimensional-trait approach to characterizing personality pathology (**Strickland, Drislane, Lucy, Krueger, & Patrick, 2013**).

Contemporary assessment methods

Modern approaches to the assessment of psychopathy, consisting of rating instruments and self-report scales, reflect the foregoing historic conceptions to differing degrees.

Psychopathy in adult criminal offenders

The most widely used instrument for diagnosing psychopathy in correctional and forensic settings is the Psychopathy Checklist-Revised (PCL-R; **Hare, 2003**), which comprises 20 items rated on the basis of interview and file-record information. The items of the PCL-R effectively capture the interpersonal-affective deficits and behavioral deviance features identified by Cleckley, but include only limited, indirect coverage of positive adjustment features. The manual for the PCL-R recommends the use of a cutoff score of 30 out of 40 for assigning a diagnosis of psychopathy. High overall PCL-R scores are correlated with impulsive and aggressive tendencies, low empathy, Machiavellianism, lack of social connectedness, and persistent violent offending. Given these correlates, and the omission of positive adjustment indicators, psychopathy as assessed by the PCL-R appears more similar to the predatory-aggressive conception of McCord and McCord than to Cleckley's conception.

Although the PCL-R was developed to index psychopathy as a unitary condition, structural analyses of its items reveal distinct *interpersonal-affective* and *antisocial deviance* subdimensions (factors). Although moderately (about .5) correlated, these factors show contrasting relations with external criterion measures. The interpersonal-affective factor relates to indices of narcissism, low empathy, and proactive aggression (**Hare, 2003**), and to some extent (after controlling for its overlap with the antisocial factor) adaptive tendencies such as high social assertiveness and low fear, distress, and depression (**Hicks & Patrick, 2006**). High scores on the antisocial deviance factor, by contrast, are associated mainly with maladaptive tendencies and behaviors, including impulsiveness, sensation seeking, alienation and mistrust, reactive aggression, early and persistent antisocial deviance, and substance-related problems.

Psychopathy in noncriminal adults



One of the key factors that the Psychopathic Personality Inventory (PPI) aims to assess is something called Fearless Dominance which includes social potency, immunity to stress, and lack of normal levels of fear.
[Image: CC0 Public Domain, <https://goo.gl/m25gce>]

Psychopathy has most typically been assessed in noncriminal adult samples using self-report-based measures. Older measures of this type emphasized the antisocial deviancy component of psychopathy with limited coverage of interpersonal-affective features (**Hare, 2003**). Some newer instruments provide more balanced coverage of both. One example is the now widely used Psychopathic Personality Inventory (PPI; Lilienfeld & Andrews, **1996**), which was

developed to index personality dispositions embodied within historic conceptions of psychopathy. Its current revised form (PPI-R; Lilienfeld & Widows, **2005**) contains 154 items, organized into eight facet scales.

Like the items of the PCL-R, the subscales of the PPI cohere around two distinguishable factors: a fearless dominance (FD) factor reflecting social potency, stress immunity, and fearlessness, and a self-centered impulsivity (SCI) factor reflecting egocentricity, exploitativeness, hostile rebelliousness, and lack of planning. However, unlike the factors of the PCL-R, the two PPI factors are uncorrelated, and thus even more distinct in their external correlates. Scores on PPI-FD are associated with indices of positive psychological adjustment (e.g., higher well-being; lower anxiety and depression) and measures of narcissism (low) empathy, and thrill/adventure

seeking (**Benning, Patrick, Blonigen, Hicks, & Iacono, 2005**). Given this, PPI-FD has been interpreted as capturing a more adaptive expression of dispositional fearlessness (i.e., *boldness*; see below) than the interpersonal-affective factor of the PCL-R—which can be viewed as tapping a more pathologic (antagonistic or “mean”) expression of fearlessness. Scores on PPI-SCI, like Factor 2 of the PCL-R, are associated with multiple indicators of deviancy—including impulsivity and aggressiveness, child and adult antisocial behavior, substance abuse problems, heightened distress and dysphoria, and suicidal ideation.

Psychopathy in child and adolescent clinical samples

Different inventories exist for assessing psychopathic tendencies in children and adolescents. The best-known consist of rating-based measures developed, using the PCL-R as a referent, to identify psychopathic individuals among youth convicted of crimes or referred for treatment of conduct problems. The emphasis in work of this type has been on the importance of psychopathic features for predicting greater severity and persistence of conduct problems. Termed “callous-unemotional” traits, these features encompass low empathy, deficient remorse or guilt, shallow affect, and lack of concern about performance in school and other contexts (**Frick & Moffitt, 2010**).

One extensively researched measure for assessing psychopathic tendencies in youth is the Antisocial Process Screening Device (APSD; **Frick & Marsee, 2006**), used with clinic-referred children ages 6 through 13. The APSD includes 20 items completed by parents or teachers. As with the PCL-R and PPI, the items of the APSD tap two distinct factors: a

Callous-Unemotional (CU) traits factor, reflecting emotional insensitivity and disregard for others; and an Impulsive/Conduct Problems (I/CP) factor, reflecting impulsivity, behavioral deviancy, and inflated self-importance. Children high on the I/CP factor alone show below-average intelligence, heightened emotional responsiveness to stressors, and angry (reactive) aggression (**Frick & Marsee, 2006**). By contrast, children high on both APSD factors show average or above-average intelligence, low reported levels of anxiety and nervousness, reduced reactivity to stressful events, and preference for activities entailing novelty and risk. They also learn less readily from punishment and engage in high levels of premeditated as well as reactive aggression and exhibit more persistent violent behavior across time. Given the documented importance of CU traits in moderating the expression of conduct disorder, the upcoming fifth edition of the DSM will include criteria for designating a distinct CU variant of child conduct disorder (**Frick & Moffitt, 2010**).

Core ingredients of psychopathy: disinhibition, boldness, and meanness

The foregoing material highlights the fact that historic conceptions of psychopathy and available instruments for assessing it place differing emphasis on different symptomatic features. This had contributed to longstanding disagreements among scholars about what psychopathy entails and what causes it. A theoretic conceptualization formulated recently to reconcile alternative perspectives is the **Triarchic model** (Patrick, Fowles, & Krueger, **2009**). This model conceives of psychopathy as encompassing three separable symptomatic components—disinhibition, boldness, and meanness—that

can be viewed as thematic building blocks for differing conceptions of psychopathy.

Definitions

Disinhibition as described in the Triarchic model encompasses tendencies toward impulsiveness, weak behavioral restraint, hostility and mistrust, and difficulties in regulating emotion. *Meanness* entails deficient empathy, lack of affiliative capacity, contempt toward others, predatory exploitativeness, and empowerment through cruelty and destructiveness. Referents for disinhibition and meanness include the

finding of distinct I/CP and CU factors in the child psychopathy literature and corresponding evidence for distinct disinhibitory and callous-aggression factors underlying impulse control (externalizing) problems in adults (Krueger, Markon, Patrick, Benning, & Kramer, **2007**). The third construct in the model, *Boldness*, encompasses dominance, social assurance, emotional resiliency, and venturesomeness. Referents for this construct include the “mask” elements of Cleckley’s conception, Lykken’s (1995) low fear theory of psychopathy, the FD factor of the PPI, and developmental research on fearless temperament as a possible precursor to psychopathy (Patrick et al., 2009).

From the perspective of the Triarchic model, Cleckley’s



Cruelty and lack of empathy are tendencies found in those with psychopathic personality. [Image: Thomas Ricker, <https://goo.gl/igmuzh>, CC BY 2.0, <https://goo.gl/BRvSA7>]

conception of psychopathy emphasized boldness and disinhibition, whereas criminally oriented conceptions (and affiliated measures, including the PCL-R and APSD) emphasize meanness and disinhibition more so. According to the model, individuals high in disinhibitory tendencies would warrant a diagnosis of psychopathy if also high in boldness or meanness (or both), but individuals high on only one of these tendencies would not. Individuals with differing relative elevations on these three symptomatic components would account for contrasting variants (subtypes) of psychopathy as described in the literature (**Hicks, Markon, Patrick, Krueger, & Newman, 2004; Karpman, 1941; Skeem, Johansson, Andershed, Kerr, & Louden, 2007**).

An inventory designed specifically to operationalize this model is the Triarchic Psychopathy Measure (TriPM; **Patrick, 2010**). The TriPM contains 58 items comprising three subscales that correspond to the constructs of the model (see Table 1). The items of the Disinhibition and Meanness scales (20 and 19 items, respectively) are taken from the Externalizing Spectrum Inventory (ESI; **Krueger et al., 2007**), a measure of problems and traits associated with externalizing psychopathology. The TriPM Boldness scale was developed to index fearless tendencies in social, affective-experiential, and activity preference domains, with reference to the FD factor of the PPI and the general factor shown to underlie differing scale measures of fear and fearlessness (**Kramer, Patrick, Gasperi, & Krueger, 2012**).

TriPM Subscale	Sample Item
Boldness	32. I can get over things that would traumatize others.
	38. I can convince people to do what I want.
	47. I stay away from physical danger as much as I can. (False)
Meanness	2. How other people feel is important to me (False)
	23. I enjoy pushing people around sometimes.
	33. I've injured people to see them in pain.
Disinhibition	3. I often act on immediate needs.
	21. I have good control over myself. (False)
	56. I have had problems at work because I was irresponsible.

Table 1. Sample items from the Triarchic Psychopathy Measure (TriPM; Patrick, 2010)

Although the TriPM is relatively new, promising evidence for its convergent and discriminant validity has begun to appear (e.g., **Sellbom & Phillips, 2013**; **Strickland et al., 2013**; see also **Venables & Patrick, 2012**). Given that the inventory is freely available online, and that several foreign-language translations now exist (including Brazilian-Portuguese, Dutch, Finnish, German, Italian, Portuguese, Swedish, and Spanish), it can be expected that additional validity data will accumulate rapidly over time. Work is also being done to evaluate whether effective scale measures of the Triarchic constructs can be derived from items of other existing psychopathy inventories such as the PPI. As discussed in the last part of this section, research examining the common and distinctive correlates of these three components of psychopathy is likely to be helpful for addressing and perhaps resolving ongoing points of uncertainty and debate in the field.

Causal factors

Considerable research has been devoted over many years to investigation of causal factors in psychopathy. Existing theories are of two types: (1) theories emphasizing core deficits in emotional sensitivity or responsiveness, and (2) theories positing basic impairments in cognitive-attentional processing (**Patrick & Bernat, 2009**). In support of these alternative theories, differing neurobiological correlates of psychopathy have been reported. One of the most consistent entails a lack of normal enhancement of the startle blink reflex to abrupt noises occurring during viewing of aversive foreground stimuli (e.g., scary or disturbing pictorial images) as compared with neutral or pleasant stimuli (see Figure 1). This result, akin to a failure to “jump” upon hearing a trash can tip while walking alone in a dark alley, has been interpreted as reflecting a lack of normal defensive (fear) reactivity. Another fairly consistent finding involves reduced amplitude of brain potential response to intermittent target stimuli, or following incorrect responses, within cognitive performance tasks—indicative of reduced cortical-attentional processing or impaired action monitoring (**Patrick & Bernat, 2009**). Yet other research using functional neuroimaging has demonstrated deficits in basic subcortical (amygdala) reactivity to interpersonal distress cues (e.g., fearful human faces) in high-psychopathic individuals (**Jones, Laurens, Herba, Barker, & Viding, 2009; Marsh et al., 2008**).

The Triarchic model may prove to be of use for reconciling alternative causal models of psychopathy that have been proposed based on contrasting neurobiological and behavioral findings. For example, lack of startle enhancement during aversive cuing has been tied specifically to the interpersonal-affective factor of the PCL-R and the counterpart FD factor of the PPI (Figure 1)—suggesting a link to the boldness component of psychopathy. By contrast, reduced brain potential responses in cognitive tasks appear more related to

impulsive-externalizing tendencies associated with the disinhibition component of psychopathy (Carlson, Th  i, & McLaron, 2009; Patrick & Bernat, 2009). On the other hand, the finding of reduced subcortical response to affective facial cues has been tied to the CU traits factor of child/adolescent psychopathy, a referent for meanness in the Triarchic model. However, further research is needed to determine whether this finding reflects fear deficits common to meanness and boldness, or deficits in affiliative capacity or empathy specific to meanness.

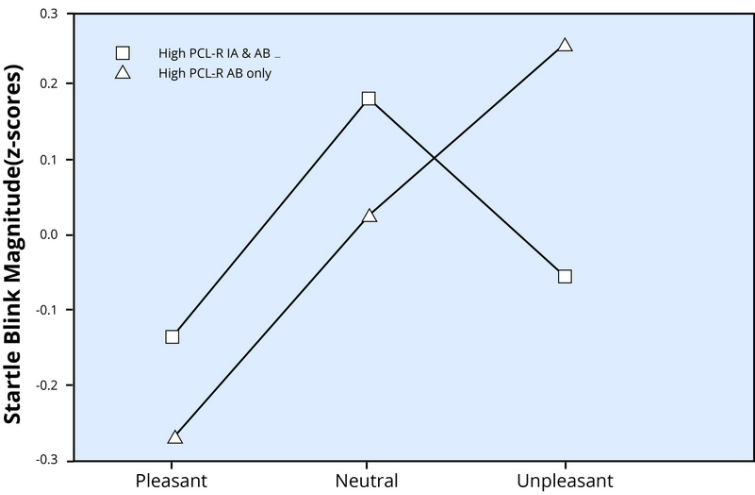
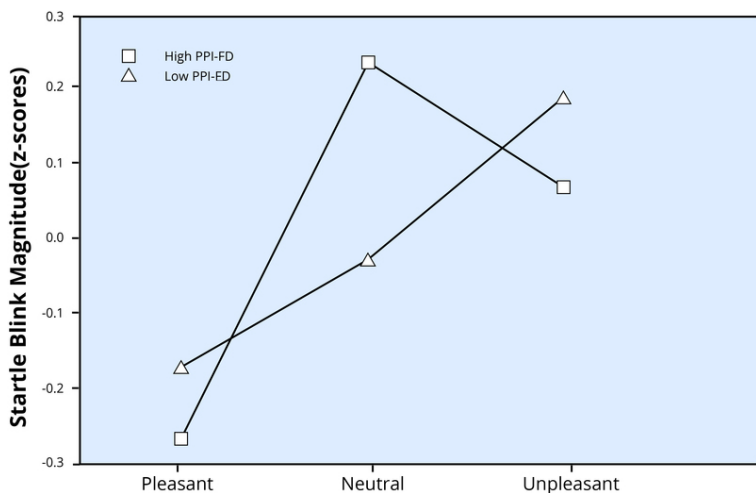


Figure 1. Evidence for lack of normal augmentation of the defensive startle reflex during viewing of aversive visual images in high-psychopathic individuals. Upper plot: Mean magnitude of startle blink responses to noise probes occurring during viewing of pleasant, neutral, and unpleasant picture stimuli in two male prisoner groups: (1) prisoners scoring high on the antisocial behavior (AB) factor of the Psychopathy Checklist-Revised (PCL-R; Hare, 2003) but not the interpersonal-affective (IA) factor (labeled “High PCL-R AB only” in the plot; n = 18), and (2) prisoners high on both factors of the PCL-R (labeled “High PCL-R IA & AB”; n = 17).



Lower plot: Mean magnitude of startle blink responses to noise probes occurring during viewing of pleasant, neutral, and unpleasant picture stimuli in two subgroups of young males from a large community sample (overall $N = 307$): (1) lowest 10% of scorers ($n = 31$) within the sample on the fearless dominance factor of the Psychopathic Personality Inventory (PPI; Lilienfeld & Andrews, 1996), labeled “Low PPI-FD” in the plot, and (2) highest 10% of scorers ($n = 31$) on the PPI fearless dominance factor of the PPI, labeled “High PPI-FD” in the plot.

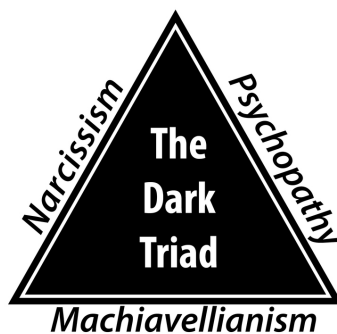
In both plots, blink means for each picture type are presented in z-score units ($M = 0$, $SD = 1$) derived by standardizing raw blink magnitude scores across trials for each individual subject. Data in the upper plot are from Patrick, Bradley, and Lang (1993); data in the lower plot are from Benning, Patrick, and Iacono (2005).

Triarchic model perspective on long-debated issues regarding psychopathy

As highlighted in the foregoing sections, scholars have grappled with issues of definition since psychopathy was first identified as a condition of clinical concern, and questions regarding its essential features and alternative expressions

continue to be debated and studied. This final subsection discusses how some of the major issues of debate are addressed by the Triarchic model.

One key issue is whether psychological/emotional stability is characteristic or not of psychopathy. Cleckley's (1941/1976) view was that psychopathy entails a salient presentation of good mental health, and his diagnostic criteria included indicators of positive adjustment. By contrast, the dominant clinical assessment devices for psychopathy, the PCL-R and ASPD, are heavily oriented



Social psychologists classify a collection of three personality traits as the "dark triad": Machiavellianism, psychopathy, and narcissism.

toward deviancy and include no items that are purely indicative of adjustment. From a Triarchic model standpoint, the more adaptive elements of psychopathy are embodied in its boldness facet, which entails social poise, emotional stability, and enjoyment of novelty and adventure. At the same time, high boldness is also associated with narcissistic tendencies, reduced sensitivity to the feelings of others, and risk-taking (Benning et al., 2005). Thus, the concept of boldness provides a way to think about the intriguing "mask" element of psychopathy.

Related to this, another issue is whether lack of anxiety is central to psychopathy, as Cleckley and others (e.g., Fowles & Dindo, 2009; Lykken, 1995) have emphasized. This perspective is challenged by research showing either negligible or somewhat positive associations for overall scores on the PCL-R and other psychopathy measures with anxiety. The Triarchic model helps to address this inconsistency by separating the

disorder into subcomponents or facets, which relate differently to measures of trait anxiety: Boldness is correlated negatively with anxiousness (**Benning et al., 2005**), whereas Disinhibition and Meanness are correlated negatively and negligibly, respectively, with anxiety (**Venables & Patrick, 2012**). Related to this, cluster analytic studies of criminal offenders exhibiting high overall scores on the PCL-R have demonstrated one subtype characterized by low anxiety in particular, and another exhibiting high anxiety along with very high levels of impulsivity and aggression (**Hicks et al., 2004; Skeem et al., 2007**). The implication is that low anxiousness is central to one variant of criminal psychopathy (the bold-disinhibited, or “primary” type) but not to another variant (the “disinhibited-mean,” “aggressive-externalizing,” or “secondary” type).

A further key question is whether violent/aggressive tendencies are typical of psychopathic individuals and should be included in the definition of the disorder. Cleckley’s (1941/1976) view was that “such tendencies should be regarded as the exception rather than as the rule” (p. 262). However, aggressiveness is central to criminally oriented conceptions of psychopathy, and the PCL-R includes an item reflecting hot-temperedness and aggression (“poor behavioral controls”) along with other items scored in part based on indications of cruelty and violence. In the Triarchic model, tendencies toward aggression are represented in both the disinhibition and meanness constructs, and a “mean-disinhibited” type of psychopath clearly exists, marked by the presence of salient aggressive behavior (**Frick & Marsee, 2006; Hicks et al., 2004**). Thus, Cleckley’s idea of aggression as ancillary to psychopathy may apply more to a variant of psychopathy that entails high boldness in conjunction with high disinhibition (**Hicks et al., 2004**).

Another question is whether criminal or antisocial behavior more broadly represents a defining feature of psychopathy, or a secondary manifestation (**Cooke, Michie, Hart, & Clark, 2004**).

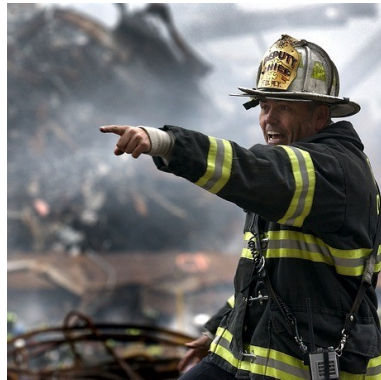
From the standpoint of the Triarchic model, antisocial behavior arises from the complex interplay of different “deviance-promoting” influences—including dispositional boldness, meanness, and disinhibition. However, whether approaches can be developed for classifying antisocial behaviors in ways that relate more selectively to these and other distinct influences (e.g., through reference to underlying motives, spontaneity versus premeditation) is an important topic to be addressed in future research.

Another key question is whether differing subtypes of psychopathy exist. From the perspective of the Triarchic model, alternative variants of psychopathy reflect differing configurations of boldness, meanness, and disinhibition. Viewed this way, designations such as “bold-disinhibited” and “mean-disinhibited” may prove more useful for research and clinical purposes than labels like “primary” versus “secondary” or “low anxious” versus “high anxious.” An issue from this perspective is whether individuals who are high in boldness and/or meanness but low in disinhibition would qualify for a diagnosis of psychopathy. For example, should a high-bold/high-mean individual (e.g., a ruthless corporate executive, like the one portrayed by actor Michael Douglas in the film *Wall Street*; **Pressman & Stone, 1987**)—or an extremely mean/vicious but neither bold nor pervasively disinhibited individual, such as Russian serial murder Andrei Chikatilo (**Cullen, 1993**)—be considered psychopathic? Questions of this sort will need to be addressed through elaborations of existing theories in conjunction with further systematic research.

Yet another question is whether psychopathy differs in women as compared to men. Cleckley’s descriptive accounts of psychopathic patients included two female case examples along with multiple male cases, and his view was that psychopathy clearly exists in women and reflects the same core deficit (i.e., absence of “major emotional accompaniments” of experience) as in men. However, men exhibit criminal deviance

and ASPD at much higher rates than women (**APA, 2000**) and men in the population at large score higher in general on measures of psychopathy than women (**Hare, 2003; Lilienfeld & Widows, 2005**). From a Triarchic model perspective, these differences in prevalence may be attributable largely to differences between women and men in average levels of boldness, meanness, and disinhibition. Some supportive evidence exists for this hypothesis (e.g., findings of **Hicks et al., 2007**) demonstrating mediation of gender differences in ASPD symptoms by levels of externalizing proneness). Beyond this, it is important also to consider whether underlying psychopathic dispositions in men and women may be manifested differently in overt behavior (**Verona & Vitale, 2006**). Some intriguing evidence exists for this—including twin research findings demonstrating a genetic association between dispositional boldness (as indexed by estimated scores on PPI-FD) and a composite index of externalizing problems in male but not female participants (**Blonigen, Hicks, Patrick, Krueger, Iacono, & McGue, 2005**). However, more extensive research along these lines, examining all facets of the Triarchic model in relation to behavioral outcomes of differing kinds, will be required to effectively address the question of gender-moderated expression.

A final intriguing question is whether “successful” psychopaths exist. Hall and Benning (2006) hypothesized that successful psychopathy entails a preponderance of certain causal influences (resulting in particular symptomatic features) over others. Drawing on known correlates of PPI-FD (e.g., Benning et al., 2005; Ross, Benning, Patrick, Thompson, & Thurston, 2009) and theories positing separate etiologic



Some aspects of the psychopathic personality could be beneficial in certain professions requiring leadership and courage. [Image: CCO Public Domain, <https://goo.gl/m25gce>]

mechanisms for differing features of psychopathy (Fowles & Dindo, 2009; Patrick & Bernat, 2009), these authors proposed that the presence of dispositional fearlessness (boldness) may be conducive to success when not accompanied by high externalizing proneness (disinhibition). For example, high-bold/low-disinhibited individuals could be expected to achieve higher success in occupations calling for leadership and/or courage because their psychopathic tendencies are manifested mainly in terms of social effectiveness, affective resilience, and venturesomeness.

Data relevant to this idea come from an intriguing study by Lilienfeld, Waldman, Landfield, Rubenzer, and Faschingbauer (2012), who used personality trait ratings of former U.S. presidents provided by expert historians to estimate scores on the FD and SCI factors of the PPI (Ross et al., 2009). They found that higher estimated levels of PPI-FD (boldness) predicted higher ratings of presidential performance, persuasiveness, leadership, and crisis management ability, whereas higher estimated levels of SCI predicted adverse outcomes such as

documented abuses of power and impeachment proceedings. Further research on outcomes associated with high levels of boldness and/or meanness in the absence of high disinhibition should yield valuable new insights into dispositional factors underlying psychopathy and alternative ways psychopathic tendencies can be expressed.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Antisocial personality disorder

Counterpart diagnosis to psychopathy included in the third through fifth editions of the Diagnostic and Statistical Manual of Mental Disorders (DSM; APA, 2000). Defined by specific symptoms of behavioral deviancy in childhood (e.g., fighting, lying, stealing, truancy) continuing into adulthood (manifested as repeated rule-breaking, impulsiveness, irresponsibility, aggressiveness, etc.).

Psychopathy

Synonymous with psychopathic personality, the term used by Cleckley (1941/1976), and adapted from the term psychopathic introduced by German psychiatrist Julius Koch (1888) to designate mental disorders presumed to be

heritable.

Triarchic model

Model formulated to reconcile alternative historic conceptions of psychopathy and differing methods for assessing it. Conceives of psychopathy as encompassing three symptomatic components: boldness, involving social efficacy, emotional resiliency, and venturesomeness; meanness, entailing lack of empathy/emotional-sensitivity and exploitative behavior toward others; and disinhibition, entailing deficient behavioral restraint and lack of control over urges/emotional reactions.

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60. Therapeutic Orientations

Original chapter by Hannah Boettcher,
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adapted by the Queen's University
Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen’s Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

In the past century, a number of psychotherapeutic orientations have gained popularity for treating mental illnesses. This module outlines some of the best-known therapeutic approaches and explains the history, techniques, advantages, and disadvantages associated with each. The most effective modern approach is cognitive behavioral therapy (CBT). We also discuss psychoanalytic therapy, person-centered therapy, and mindfulness-based approaches. Drug therapy and emerging new treatment strategies will also be briefly explored.

Learning Objectives

- Become familiar with the most widely

practiced approaches to psychotherapy.

- For each therapeutic approach, consider: history, goals, key techniques, and empirical support.
- Consider the impact of emerging treatment strategies in mental health.

Introduction

The history of mental illness can be traced as far back as 1500 BCE, when the ancient Egyptians noted cases of “distorted concentration” and “emotional distress in the heart or mind” (**Nasser, 1987**). Today, nearly half of all Americans will experience mental illness at some point in their lives, and mental health problems affect more than one-quarter of the population in any given year (**Kessler et al., 2005**). Fortunately, a range of psychotherapies exist to treat mental illnesses. This module provides an overview of some of the best-known schools of thought in psychotherapy. Currently, the most effective approach is called Cognitive Behavioral Therapy (CBT); however, other approaches, such as psychoanalytic therapy, person-centered therapy, and mindfulness-based therapies are also used—though the effectiveness of these treatments aren’t as clear as they are for CBT. Throughout this module, note the advantages and disadvantages of each approach, paying special attention to their support by empirical research.



CBT is an approach to treating mental illness that involves work with a therapist as well as homework assignments between sessions. It has proven to be very effective for virtually all psychiatric illnesses. [Image: DFAT, <https://goo.gl/bWmzaa>, CC BY 2.0, <https://goo.gl/BRvSA7>]

Psychoanalysis and Psychodynamic Therapy

The earliest organized therapy for mental disorders was psychoanalysis. Made famous in the early 20th century by one of the best-known clinicians of all time, Sigmund Freud, this approach stresses that mental health problems are rooted in unconscious conflicts and desires. In order to resolve the mental illness, then, these unconscious struggles must be identified and addressed. Psychoanalysis often does this through exploring one's early childhood experiences that may have continuing repercussions on one's mental health in the

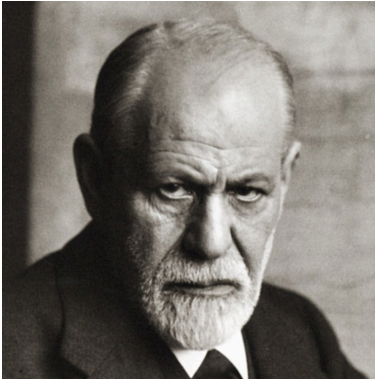
present and later in life. Psychoanalysis is an intensive, long-term approach in which patients and therapists may meet multiple times per week, often for many years.

History of Psychoanalytic Therapy

Freud initially suggested that mental health problems arise from efforts to push inappropriate sexual urges out of conscious awareness (**Freud, 1895/1955**). Later, Freud suggested more generally that psychiatric problems are the result of tension between different parts of the mind: the id, the superego, and the ego. In Freud's *structural model*, the id represents pleasure-driven unconscious urges (e.g., our animalistic desires for sex and aggression), while the superego is the semi-conscious part of the mind where morals and societal judgment are internalized (e.g., the part of you that automatically knows how society expects you to behave). The ego—also partly conscious—mediates between the id and superego. Freud believed that bringing unconscious struggles like these (where the id demands one thing and the superego another) into conscious awareness would relieve the stress of the conflict (**Freud, 1920/1955**)—which became the goal of **psychoanalytic therapy**.

Although psychoanalysis is still practiced today, it has largely been replaced by the more broadly defined **psychodynamic therapy**. This latter approach has the same basic tenets as psychoanalysis, but is briefer, makes more of an effort to put clients in their social and interpersonal context, and focuses more on relieving psychological distress than on changing the person.

Techniques in Psychoanalysis



Building on the work of Josef Breuer and others, Sigmund Freud developed psychotherapeutic theories and techniques that became widely known as psychoanalysis or psychoanalytic therapy. [Image: CC0 Public Domain, <https://goo.gl/m25gce>]

Psychoanalysts and psychodynamic therapists employ several techniques to explore patients' unconscious mind. One common technique is called **free association**. Here, the patient shares any and all thoughts that come to mind, without attempting to organize or censor them in any way. For example, if you took a pen and paper and just wrote down whatever came into your head, letting one thought lead to the next without allowing conscious

criticism to shape what you were writing, you would be doing free association. The analyst then uses their expertise to discern patterns or underlying meaning in the patient's thoughts.

Sometimes, free association exercises are applied specifically to childhood recollections. That is, psychoanalysts believe a person's childhood relationships with caregivers often determine the way that person relates to others, and predicts later psychiatric difficulties. Thus, exploring these childhood memories, through free association or otherwise, can provide therapists with insights into a patient's psychological makeup.

Because we don't always have the ability to consciously recall these deep memories, psychoanalysts also discuss their patients' dreams. In Freudian theory, dreams contain not only *manifest* (or literal) content, but also *latent* (or symbolic)

content (**Freud, 1900; 1955**). For example, someone may have a dream that their teeth are falling out—the manifest or actual content of the dream. However, dreaming that one's teeth are falling out could be a reflection of the person's unconscious concern about losing their physical attractiveness—the latent or metaphorical content of the dream. It is the therapist's job to help discover the latent content underlying one's manifest content through dream analysis.

In psychoanalytic and psychodynamic therapy, the therapist plays a receptive role—interpreting the patient's thoughts and behavior based on clinical experience and psychoanalytic theory. For example, if during therapy a patient begins to express unjustified anger toward the therapist, the therapist may recognize this as an act of *transference*. That is, the patient may be displacing feelings for people in their life (e.g., anger toward a parent) onto the therapist. At the same time, though, the therapist has to be aware of their own thoughts and emotions, for, in a related process, called *countertransference*, the therapist may displace their own emotions onto the patient.

The key to psychoanalytic theory is to have patients uncover the buried, conflicting content of their mind, and therapists use various tactics—such as seating patients to face away from them—to promote a freer self-disclosure. And, as a therapist spends more time with a patient, the therapist can come to view their relationship with the patient as another reflection of the patient's mind.

Advantages and Disadvantages of Psychoanalytic Therapy

Psychoanalysis was once the only type of psychotherapy available, but presently the number of therapists practicing

this approach is decreasing around the world. Psychoanalysis is not appropriate for some types of patients, including those with severe psychopathology or intellectual disability. Further, psychoanalysis is often expensive because treatment usually lasts many years. Still, some patients and therapists find the prolonged and detailed analysis very rewarding.

Perhaps the greatest disadvantage of psychoanalysis and related approaches is the lack of empirical support for their effectiveness. The limited research that has been conducted on these treatments suggests that they do not reliably lead to better mental health outcomes (e.g., **Driessen et al., 2010**). And, although there are some reviews that seem to indicate that long-term psychodynamic therapies might be beneficial (e.g., **Leichsenring & Rabung, 2008**), other researchers have questioned the validity of these reviews. Nevertheless, psychoanalytic theory was history's first attempt at formal treatment of mental illness, setting the stage for the more modern approaches used today.

Humanistic and Person-Centered Therapy

One of the next developments in therapy for mental illness, which arrived in the mid-20th century, is called humanistic or **person-centered therapy** (PCT). Here, the belief is that mental health problems result from an inconsistency between patients' behavior and their true personal identity. Thus, the goal of PCT is to create conditions under which patients can discover their self-worth, feel comfortable exploring their own identity, and alter their behavior to better reflect this identity.

History of Person-Centered Therapy

PCT was developed by a psychologist named Carl Rogers, during a time of significant growth in the movements of humanistic theory and human potential. These perspectives were based on the idea that humans have an inherent drive to realize and express their own capabilities and creativity. Rogers, in particular, believed that all



The quality of the relationship between therapist and patient is of great importance in person-centered therapy. [Image: CC0 Public Domain, <https://goo.gl/m25gce>]

people have the potential to change and improve, and that the role of therapists is to foster self-understanding in an environment where adaptive change is most likely to occur (**Rogers, 1951**). Rogers suggested that the therapist and patient must engage in a genuine, egalitarian relationship in which the therapist is nonjudgmental and empathetic. In PCT, the patient should experience both a vulnerability to anxiety, which motivates the desire to change, and an appreciation for the therapist's support.

Techniques in Person-Centered Therapy

Humanistic and person-centered therapy, like psychoanalysis, involves a largely unstructured conversation between the therapist and the patient. Unlike psychoanalysis, though, a therapist using PCT takes a passive role, guiding the patient toward their own self-discovery. Rogers's original name for PCT was *non-directive therapy*, and this notion is reflected in the

flexibility found in PCT. Therapists do not try to change patients' thoughts or behaviors directly. Rather, their role is to provide the therapeutic relationship as a platform for personal growth. In these kinds of sessions, the therapist tends only to ask questions and doesn't provide any judgment or interpretation of what the patient says. Instead, the therapist is present to provide a safe and encouraging environment for the person to explore these issues for themselves.

An important aspect of the PCT relationship is the therapist's **unconditional positive regard** for the patient's feelings and behaviors. That is, the therapist is never to condemn or criticize the patient for what s/he has done or thought; the therapist is only to express warmth and empathy. This creates an environment free of approval or disapproval, where patients come to appreciate their value and to behave in ways that are congruent with their own identity.

Advantages and Disadvantages of Person-Centered Therapy

One key advantage of person-centered therapy is that it is highly acceptable to patients. In other words, people tend to find the supportive, flexible environment of this approach very rewarding. Furthermore, some of the themes of PCT translate well to other therapeutic approaches. For example, most therapists of any orientation find that clients respond well to being treated with nonjudgmental empathy. The main disadvantage to PCT, however, is that findings about its effectiveness are mixed. One possibility for this could be that the treatment is primarily based on *unspecific treatment factors*. That is, rather than using therapeutic techniques that are specific to the patient and the mental problem (i.e., *specific treatment factors*), the therapy focuses on techniques that can

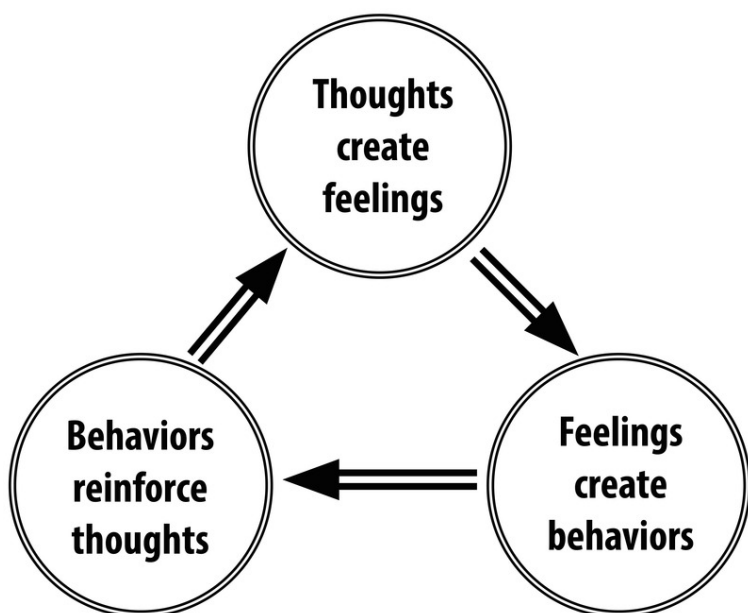
be applied to anyone (e.g., establishing a good relationship with the patient) (Cuijpers et al., 2012; Friedli, King, Lloyd, & Horder, 1997). Similar to how “one-size-fits-all” doesn’t really fit every person, PCT uses the same practices for everyone, which may work for some people but not others. Further research is necessary to evaluate its utility as a therapeutic approach.

Cognitive Behavioral Therapy

Although both psychoanalysis and PCT are still used today, another therapy, **cognitive-behavioral therapy (CBT)**, has gained more widespread support and practice. CBT refers to a family of therapeutic approaches whose goal is to alleviate psychological symptoms by changing their underlying cognitions and behaviors. The premise of CBT is that thoughts, behaviors, and emotions interact and contribute to various mental disorders. For example, let’s consider how a CBT therapist would view a patient who compulsively washes their hands for hours every day. First, the therapist would identify the patient’s maladaptive thought: “If I don’t wash my hands like this, I will get a disease and die.” The therapist then identifies how this maladaptive *thought* leads to a maladaptive *emotion*: the feeling of anxiety when their hands aren’t being washed. And finally, this maladaptive emotion leads to the maladaptive behavior: the patient washing their hands for hours every day.

CBT is a present-focused therapy (i.e., focused on the “now” rather than causes from the past, such as childhood relationships) that uses behavioral goals to improve one’s mental illness. Often, these behavioral goals involve between-session homework assignments. For example, the therapist may give the hand-washing patient a worksheet to take home; on this worksheet, the patient is to write down every time they feel the urge to wash their hands, how they deal with the urge, and what behavior they replace that urge with. When the

patient has their next therapy session, the patient and the therapist review the patient's "homework" together. CBT is a relatively brief intervention of 12 to 16 weekly sessions, closely tailored to the nature of the psychopathology and treatment of the specific mental disorder. And, as the empirical data shows, CBT has proven to be highly efficacious for virtually all psychiatric illnesses (Hofmann, Asnaani, Vonk, Sawyer, & Fang, 2012).



Pattern of thoughts, feelings, and behaviors addressed through cognitive-behavioral therapy.

History of Cognitive Behavioral Therapy

CBT developed from clinical work conducted in the mid-20th century by Dr. Aaron T. Beck, a psychiatrist, and Albert Ellis, a psychologist. Beck used the term **automatic thoughts** to refer

to the thoughts depressed patients report experiencing spontaneously. He observed that these thoughts arise from three belief systems, or **schemas**: beliefs about the self, beliefs about the world, and beliefs about the future. In treatment, therapy initially focuses on identifying automatic thoughts (e.g., “If I don’t wash my hands constantly, I’ll get a disease”), testing their validity, and replacing maladaptive thoughts with more adaptive thoughts (e.g., “Washing my hands three times a day is sufficient to prevent a disease”). In later stages of treatment, the patient’s maladaptive schemas are examined and modified. Ellis (1957) took a comparable approach, in what he called rational-emotive-behavioral therapy (REBT), which also encourages patients to evaluate their own thoughts about situations.

Techniques in CBT

Beck and Ellis strove to help patients identify maladaptive appraisals, or the untrue judgments and evaluations of certain thoughts. For example, if it’s your first time meeting new people, you may have the automatic thought, “These people won’t like me because I have nothing interesting to share.” That thought itself is not what’s troublesome; the appraisal (or evaluation) that it might have merit is what’s troublesome. The goal of CBT is to help people make adaptive, instead of maladaptive, appraisals (e.g., “I do know interesting things!”). This technique of **reappraisal, or cognitive restructuring**, is a fundamental aspect of CBT. With cognitive restructuring, it is the therapist’s job to help point out when a person has an inaccurate or maladaptive thought, so that the patient can either eliminate it or modify it to be more adaptive.

In addition to *thoughts*, though, another important treatment target of CBT is maladaptive *behavior*. Every time a person engages in maladaptive behavior (e.g., never speaking

to someone in new situations), he or she reinforces the validity of the maladaptive thought, thus maintaining or perpetuating the psychological illness. In treatment, the therapist and patient work together to develop healthy behavioral habits (often tracked with worksheet-like homework), so that the patient can break this cycle of maladaptive thoughts and behaviors.

For many mental health problems, especially anxiety disorders, CBT incorporates what is known as **exposure therapy**. During exposure therapy, a patient confronts a problematic situation and fully engages in the experience instead of avoiding it. For example, imagine a person who is terrified of spiders. Whenever they encounter one, they immediately scream and panic. In exposure therapy, the patient would be forced to confront and interact with spiders, rather than simply avoiding them as they usually do. The goal is to reduce the fear associated with the situation through *extinction learning*, a neurobiological and cognitive process by which the patient “unlearns” the irrational fear. For example, exposure therapy for someone terrified of spiders might begin with them looking at a cartoon of a spider, followed by looking at pictures of real spiders, and later, the patient handling a plastic spider. After weeks of this incremental exposure, the patient may even be able to hold a live spider. After repeated exposure (starting small and building one’s way up), the patient experiences less physiological fear and maladaptive thoughts about spiders, breaking their tendency for anxiety and subsequent avoidance.

Advantages and Disadvantages of CBT

CBT interventions tend to be relatively brief, making them cost-effective for the average consumer. In addition, CBT is an intuitive treatment that makes logical sense to patients. It can

also be adapted to suit the needs of many different populations. One disadvantage, however, is that CBT does involve significant effort on the patient's part, because the patient is an active participant in treatment. Therapists often assign "homework" (e.g., worksheets for recording one's thoughts and behaviors) between sessions to maintain the cognitive and behavioral habits the patient is working on. The greatest strength of CBT is the abundance of empirical support for its effectiveness. Studies have consistently found CBT to be equally or more effective than other forms of treatment, including medication and other therapies (**Butler, Chapman, Forman, & Beck, 2006; Hofmann et al., 2012**). For this reason, CBT is considered a first-line treatment for many mental disorders.

Focus Topic: Pioneers of CBT

The central notion of CBT is the idea that a person's behavioral and emotional responses are causally influenced by one's thinking. The stoic Greek philosopher Epictetus is quoted as saying, "men are not moved by things, but by the view they take of them." Meaning, it is not the event per se, but rather one's assumptions (including interpretations and perceptions) of the event that are responsible for one's emotional response to it. Beck calls these assumptions about events and situations automatic thoughts (**Beck, 1979**), whereas Ellis (**1962**) refers to these assumptions as self-statements. The cognitive model assumes that these cognitive processes cause the emotional and behavioral responses to events or stimuli. This causal

chain is illustrated in Ellis's ABC model, in which A stands for the antecedent event, B stands for belief, and C stands for consequence. During CBT, the person is encouraged to carefully observe the sequence of events and the response to them, and then explore the validity of the underlying beliefs through behavioral experiments and reasoning, much like a detective or scientist.

Acceptance and Mindfulness-Based Approaches

Unlike the preceding therapies, which were developed in the 20th century, this next one was born out of age-old Buddhist and yoga practices. **Mindfulness**, or a process that tries to cultivate a nonjudgmental, yet attentive, mental state, is a therapy that focuses on one's awareness of bodily sensations, thoughts, and the outside environment. Whereas other therapies work to modify or eliminate these sensations and thoughts, mindfulness focuses on nonjudgmentally accepting them (**Kabat-Zinn, 2003; Baer, 2003**). For example, whereas CBT may actively confront and work to change a maladaptive thought, mindfulness therapy works to acknowledge and accept the thought, understanding that the thought is spontaneous and not what the person truly believes. There are two important components of mindfulness: (1) self-regulation of attention, and (2) orientation toward the present moment (**Bishop et al., 2004**). Mindfulness is thought to improve mental health because it draws attention away from past and future

stressors, encourages acceptance of troubling thoughts and feelings, and promotes physical relaxation.

Techniques in Mindfulness-Based Therapy

Psychologists have adapted the practice of mindfulness as a form of psychotherapy, generally called **mindfulness-based therapy** (MBT). Several types of MBT have become popular in recent years, including *mindfulness-based stress reduction* (MBSR) (e.g., **Kabat-Zinn, 1982**) and *mindfulness-based cognitive therapy* (MBCT) (e.g., **Segal, Williams, & Teasdale, 2002**).



One of the most important advantages of mindfulness based therapy is its level of accessibility to patients. [Image: Wayne MacPhail, <https://goo.gl/aSZanf>, CC BY-NC SA 2.0, <https://goo.gl/Toc0ZF>]

MBSR uses meditation, yoga, and attention to physical experiences to reduce stress. The hope is that reducing a person's overall stress will allow that person to more objectively evaluate their thoughts. In MBCT, rather than reducing one's general stress to address a specific problem, attention is focused on one's thoughts and their associated emotions. For example, MBCT helps prevent relapses in depression by encouraging

patients to evaluate their own thoughts objectively and without value judgment (**Baer, 2003**). Although cognitive behavioral therapy (CBT) may seem similar to this, it focuses on "pushing out" the maladaptive thought, whereas mindfulness-based cognitive therapy focuses on "not getting caught up" in

it. The treatments used in MBCT have been used to address a wide range of illnesses, including depression, anxiety, chronic pain, coronary artery disease, and fibromyalgia (**Hofmann, Sawyer, Witt & Oh, 2010**).

Mindfulness and acceptance—in addition to being therapies in their own right—have also been used as “tools” in other cognitive-behavioral therapies, particularly in **dialectical behavior therapy (DBT)** (e.g., **Linehan, Amstrong, Suarez, Allmon, & Heard, 1991**). DBT, often used in the treatment of borderline personality disorder, focuses on skills training. That is, it often employs mindfulness and cognitive behavioral therapy practices, but it also works to teach its patients “skills” they can use to correct maladaptive tendencies. For example, one skill DBT teaches patients is called *distress tolerance*—or, ways to cope with maladaptive thoughts and emotions in the moment. For example, people who feel an urge to cut themselves may be taught to snap their arm with a rubber band instead. The primary difference between DBT and CBT is that DBT employs techniques that address the symptoms of the problem (e.g., cutting oneself) rather than the problem itself (e.g., understanding the psychological motivation to cut oneself). CBT does not teach such skills training because of the concern that the skills—even though they may help in the short-term—may be harmful in the long-term, by maintaining maladaptive thoughts and behaviors.

DBT is founded on the perspective of a **dialectical worldview**. That is, rather than thinking of the world as “black and white,” or “only good and only bad,” it focuses on accepting that some things can have characteristics of both “good” and “bad.” So, in a case involving maladaptive thoughts, instead of teaching that a thought is entirely bad, DBT tries to help patients be less judgmental of their thoughts (as with mindfulness-based therapy) and encourages change through therapeutic progress, using cognitive-behavioral techniques as well as mindfulness exercises.

Another form of treatment that also uses mindfulness techniques is **acceptance and commitment therapy** (ACT) (Hayes, Strosahl, & Wilson, 1999). In this treatment, patients are taught to observe their thoughts from a detached perspective (Hayes et al., 1999). ACT encourages patients *not* to attempt to change or avoid thoughts and emotions they observe in themselves, but to recognize which are beneficial and which are harmful. However, the differences among ACT, CBT, and other mindfulness-based treatments are a topic of controversy in the current literature.

Advantages and Disadvantages of Mindfulness-Based Therapy

Two key advantages of mindfulness-based therapies are their acceptability and accessibility to patients. Because yoga and meditation are already widely known in popular culture, consumers of mental healthcare are often interested in trying related psychological therapies. Currently, psychologists have not come to a consensus on the efficacy of MBT, though growing evidence supports its effectiveness for treating mood and anxiety disorders. For example, one review of MBT studies for anxiety and depression found that mindfulness-based interventions generally led to moderate symptom improvement (Hofmann et al., 2010).

Emerging Treatment Strategies



Recent improvements in video chat technology along with the proliferation of mobile devices like smartphones and tablets has made online delivery of therapy more commonplace. [Image: Noba, CC BY 2.0, <https://goo.gl/BRvSA7>]

With growth in research and technology, psychologists have been able to develop new treatment strategies in recent years. Often, these approaches focus on enhancing existing treatments, such as cognitive-behavioral therapies, through the use of technological advances. For

example, *internet-and mobile-delivered* therapies make psychological treatments more available, through smartphones and online access. Clinician-supervised online CBT modules allow patients to access treatment from home on their own schedule—an opportunity particularly important for patients with less geographic or socioeconomic access to traditional treatments. Furthermore, smartphones help extend therapy to patients' daily lives, allowing for symptom tracking, homework reminders, and more frequent therapist contact.

Another benefit of technology is **cognitive bias modification**. Here, patients are given exercises, often through the use of video games, aimed at changing their problematic thought processes. For example, researchers might use a mobile app to train alcohol abusers to avoid stimuli related to alcohol. One version of this game flashes four pictures on the screen—three alcohol cues (e.g., a can of beer, the front of a bar) and one health-related image (e.g., someone drinking water). The goal is for the patient to tap the healthy picture

as fast as s/he can. Games like these aim to target patients' automatic, subconscious thoughts that may be difficult to direct through conscious effort. That is, by repeatedly tapping the healthy image, the patient learns to "ignore" the alcohol cues, so when those cues are encountered in the environment, they will be less likely to trigger the urge to drink. Approaches like these are promising because of their accessibility, however they require further research to establish their effectiveness.

Yet another emerging treatment employs *CBT-enhancing pharmaceutical agents*. These are drugs used to improve the effects of therapeutic interventions. Based on research from animal experiments, researchers have found that certain drugs influence the biological processes known to be involved in learning. Thus, if people take these drugs while going through psychotherapy, they are better able to "learn" the techniques for improvement. For example, the antibiotic d-cycloserine improves treatment for anxiety disorders by facilitating the learning processes that occur during exposure therapy. Ongoing research in this exciting area may prove to be quite fruitful.

Pharmacological Treatments

Up until this point, all the therapies we have discussed have been talk-based or meditative practices. However, psychiatric medications are also frequently used to treat mental disorders, including schizophrenia, bipolar disorder, depression, and anxiety disorders. Psychiatric drugs are commonly used, in part, because they can be prescribed by general medical practitioners, whereas only trained psychologists are qualified to deliver effective psychotherapy. While drugs and CBT therapies tend to be almost equally effective, choosing the best intervention depends on the disorder and individual being treated, as well as other factors—such as treatment availability

and **comorbidity** (i.e., having multiple mental or physical disorders at once). Although many new drugs have been introduced in recent decades, there is still much we do not understand about their mechanism in the brain. Further research is needed to refine our understanding of both pharmacological and behavioral treatments before we can make firm claims about their effectiveness.

Integrative and Eclectic Psychotherapy

In discussing therapeutic orientations, it is important to note that some clinicians incorporate techniques from multiple approaches, a practice known as **integrative or eclectic psychotherapy**. For example, a therapist may employ distress tolerance skills from DBT (to resolve short-term problems), cognitive reappraisal from CBT (to address long-standing issues), and mindfulness-based meditation from MBCT (to reduce overall stress). And, in fact, between 13% and 42% of therapists have identified their own approaches as integrative or eclectic (**Norcross & Goldfried, 2005**).

Conclusion

Throughout human history we have had to deal with mental illness in one form or another. Over time, several schools of thought have emerged for treating these problems. Although various therapies have been shown to work for specific individuals, cognitive behavioral therapy is currently the treatment most widely supported by empirical research. Still, practices like psychodynamic therapies, person-centered therapy, mindfulness-based treatments, and acceptance and commitment therapy have also shown success. And, with

recent advances in research and technology, clinicians are able to enhance these and other therapies to treat more patients more effectively than ever before. However, what is important in the end is that people actually seek out mental health specialists to help them with their problems. One of the biggest deterrents to doing so is that people don't understand what psychotherapy really entails. Through understanding how current practices work, not only can we better educate people about how to get the help they need, but we can continue to advance our treatments to be more effective in the future.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Acceptance and commitment therapy

A therapeutic approach designed to foster nonjudgmental observation of one's own mental processes.

Automatic thoughts

Thoughts that occur spontaneously; often used to describe problematic thoughts that maintain mental disorders.

Cognitive bias modification

Using exercises (e.g., computer games) to change problematic thinking habits.

Cognitive-behavioral therapy (CBT)

A family of approaches with the goal of changing the

thoughts and behaviors that influence psychopathology.

Comorbidity

Describes a state of having more than one psychological or physical disorder at a given time.

Dialectical behavior therapy (DBT)

A treatment often used for borderline personality disorder that incorporates both cognitive-behavioral and mindfulness elements.

Dialectical worldview

A perspective in DBT that emphasizes the joint importance of change and acceptance.

Exposure therapy

A form of intervention in which the patient engages with a problematic (usually feared) situation without avoidance or escape.

Free association

In psychodynamic therapy, a process in which the patient reports all thoughts that come to mind without censorship, and these thoughts are interpreted by the therapist.

Integrative or eclectic psychotherapy

Also called integrative psychotherapy, this term refers to approaches combining multiple orientations (e.g., CBT with psychoanalytic elements).

Integrative or eclectic psychotherapy

Also called integrative psychotherapy, this term refers to approaches combining multiple orientations (e.g., CBT with psychoanalytic elements).

Mindfulness

A process that reflects a nonjudgmental, yet attentive,

mental state.

Mindfulness-based therapy

A form of psychotherapy grounded in mindfulness theory and practice, often involving meditation, yoga, body scan, and other features of mindfulness exercises.

Person-centered therapy

A therapeutic approach focused on creating a supportive environment for self-discovery.

Psychoanalytic therapy

Sigmund Freud's therapeutic approach focusing on resolving unconscious conflicts.

Psychodynamic therapy

Treatment applying psychoanalytic principles in a briefer, more individualized format.

Reappraisal, or Cognitive restructuring

The process of identifying, evaluating, and changing maladaptive thoughts in psychotherapy.

Schema

A mental representation or set of beliefs about something.

Unconditional positive regard

In person-centered therapy, an attitude of warmth, empathy and acceptance adopted by the therapist in order to foster feelings of inherent worth in the patient.

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PSYC 100 XXII

PERSONALITY

61. Personality Traits

Original chapter by Edward Diener and Richard E. Lucas adapted by the Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below. We encourage students to use the "Three-Step Method" for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link:
<https://sass.queensu.ca/psyc100/>

Personality traits reflect people's characteristic patterns of thoughts, feelings, and behaviors. Personality traits imply consistency and stability—someone who scores high on a specific trait like Extraversion is expected to be sociable in different situations and over time. Thus, trait psychology rests on the idea that people differ from one another in terms of where they stand on a set of basic trait dimensions that persist over time and across situations. The most widely used system of traits is called the Five-Factor Model. This system includes five broad traits that can be remembered with the acronym OCEAN: Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. Each of the major traits from the Big Five can be divided into facets to give a more fine-grained analysis of someone's personality. In addition, some trait theorists argue that there are other traits that cannot be completely captured by the Five-Factor Model. Critics of the trait concept argue that people do not act consistently from one situation to the next and that people are very influenced by

situational forces. Thus, one major debate in the field concerns the relative power of people's traits versus the situations in which they find themselves as predictors of their behavior.

Learning Objectives

- List and describe the “Big Five” (“OCEAN”) personality traits that comprise the Five-Factor Model of personality.
- Describe how the facet approach extends broad personality traits.
- Explain a critique of the personality-trait concept.
- Describe in what ways personality traits may be manifested in everyday behavior.
- Describe each of the Big Five personality traits, and the low and high end of the dimension.
- Give examples of each of the Big Five personality traits, including both a low and high example.
- Describe how traits and social learning combine to predict your social activities.
- Describe your theory of how personality traits get refined by social learning.

Introduction

When we observe people around us, one of the first things that strikes us is how different people are from one another. Some people are very talkative while others are very quiet. Some are active whereas others are couch potatoes. Some worry a lot, others almost never seem anxious. Each time we use one of these words, words like “talkative,” “quiet,” “active,” or “anxious,” to describe those around us, we are talking about a person's **personality**—the characteristic ways that people differ

from one another. Personality psychologists try to describe and understand these differences.

Although there are many ways to think about the personalities that people have, Gordon Allport and other “personologists” claimed that we can best understand the differences between individuals by understanding their personality traits. **Personality**

traits reflect basic dimensions on which people differ (Matthews, Deary, & Whiteman, 2003). According to trait psychologists, there are a limited number of these dimensions (dimensions like Extraversion,

Conscientiousness, or

Agreeableness), and each individual falls somewhere on each dimension, meaning that they could be low, medium, or high on any specific trait.

An important feature of personality traits is that they reflect **continuous distributions** rather than distinct personality types. This means that when personality psychologists talk about Introverts and Extraverts, they are not really talking about two distinct types of people who are completely and qualitatively different from one another. Instead, they are talking about people who score relatively low or relatively high along a continuous distribution. In fact, when personality psychologists measure traits like **Extraversion**, they typically find that most people score somewhere in the middle, with smaller numbers showing more extreme levels. The figure



“Are you an introvert”? In popular culture it's common to talk about people being introverts or extroverts as if these were precise descriptions that meant the same thing for everyone. But research shows that these traits and others are quite variable within individuals. [Image: Nguyen Hung Vu, <https://goo.gl/qKJUAC>, CC BY 2.0, <https://goo.gl/BRvSA7>]

below shows the distribution of Extraversion scores from a survey of thousands of people. As you can see, most people report being moderately, but not extremely, extraverted, with fewer people reporting very high or very low scores.

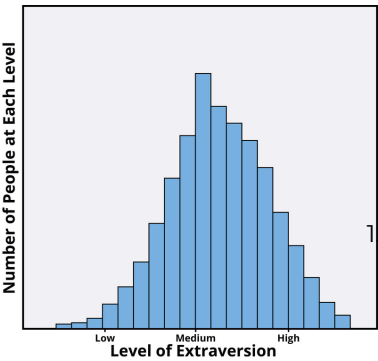


Figure 1. Distribution of Extraversion Scores in a Sample Higher bars mean that more people have scores of that level. This figure shows that most people score towards the middle of the extraversion scale, with fewer people who are highly extraverted or highly introverted.

There are three criteria that are characterize personality traits: (1) consistency, (2) stability, and (3) individual differences.

To have a personality trait, individuals must be somewhat consistent across situations in their behaviors related to the trait. For example, if they are talkative at home, they tend also to be talkative at work.

2. Individuals with a trait are also somewhat stable over time in behaviors related to the trait. If they are talkative, for example, at age 30, they will also tend to be talkative at age 40.
3. People differ from one another on behaviors related to the trait. Using speech is not a personality trait and neither is walking on two feet—virtually all individuals do these activities, and there are almost no individual differences. But people differ on how frequently they talk and how active they are, and thus personality traits such as Talkativeness and Activity Level do exist.

A challenge of the trait approach was to discover the major traits on which all people differ. Scientists for many decades generated hundreds of new traits, so that it was soon difficult to keep track and make sense of them. For instance, one

psychologist might focus on individual differences in “friendliness,” whereas another might focus on the highly related concept of “sociability.” Scientists began seeking ways to reduce the number of traits in some systematic way and to discover the basic traits that describe most of the differences between people.

The way that Gordon Allport and his colleague Henry Odbert approached this was to search the dictionary for all descriptors of personality (**Allport & Odbert, 1936**). Their approach was guided by the **lexical hypothesis**, which states that all important personality characteristics should be reflected in the language that we use to describe other people. Therefore, if we want to understand the fundamental ways in which people differ from one another, we can turn to the words that people use to describe one another. So if we want to know what words people use to describe one another, where should we look? Allport and Odbert looked in the most obvious place—the dictionary. Specifically, they took all the personality descriptors that they could find in the dictionary (they started with almost 18,000 words but quickly reduced that list to a more manageable number) and then used statistical techniques to determine which words “went together.” In other words, if everyone who said that they were “friendly” also said that they were “sociable,” then this might mean that personality psychologists would only need a single trait to capture individual differences in these characteristics. Statistical techniques were used to determine whether a small number of dimensions might underlie all of the thousands of words we use to describe people.

The Five-Factor Model of Personality

Research that used the lexical approach showed that many of the personality descriptors found in the dictionary do indeed

overlap. In other words, many of the words that we use to describe people are synonyms. Thus, if we want to know what a person is like, we do not necessarily need to ask how sociable they are, how friendly they are, and how gregarious they are. Instead, because sociable people tend to be friendly and gregarious, we can summarize this personality dimension with a single term. Someone who is sociable, friendly, and gregarious would typically be described as an “Extravert.” Once we know she is an extravert, we can assume that she is sociable, friendly, and gregarious.

Statistical methods (specifically, a technique called **factor analysis**) helped to determine whether a small number of dimensions underlie the diversity of words that people like Allport and Odbert identified. The most widely accepted system to emerge from this approach was “The Big Five” or “**Five-Factor Model**” (Goldberg, 1990; McCrae & John, 1992; McCrae & Costa, 1987). The Big Five comprises five major traits shown in the Figure 2 below. A way to remember these five is with the acronym OCEAN (O is for **Openness**; C is for **Conscientiousness**; E is for **Extraversion**; A is for **Agreeableness**; N is for **Neuroticism**). Figure 3 provides descriptions of people who would score high and low on each of these traits.

Big 5 Trait	Definition
<i>Openness</i>	The tendency to appreciate new art, ideas, values, feelings, and behaviors.
<i>Conscientiousness</i>	The tendency to be careful, on-time for appointments, to follow rules, and to be hardworking.
<i>Extraversion</i>	The tendency to be talkative, sociable, and to enjoy others; the tendency to have a dominant style.
<i>Agreeableness</i>	The tendency to agree and go along with others rather than to assert one's own opinions and choices.
<i>Neuroticism</i>	The tendency to frequently experience negative emotions such as anger, worry, and sadness, as well as being interpersonally sensitive.

Figure 2. Descriptions of the Big Five Personality Traits

Big 5 Trait	Example Behavior for LOW Scorers	Example Behavior for HIGH Scorers
<i>Openness</i>	Prefers not to be exposed to alternative moral systems; narrow interests; inartistic; not analytical; down-to-earth	Enjoys seeing people with new types of haircuts and body piercing; curious; imaginative; untraditional
<i>Conscientiousness</i>	Prefers spur-of-the-moment action to planning; unreliable; hedonistic; careless; lax	Never late for a date; organized; hardworking; neat; persevering; punctual; self-disciplined
<i>Extraversion</i>	Preferring a quiet evening reading to a loud party; sober; aloof; unenthusiastic	Being the life of the party; active; optimistic; fun-loving; affectionate
<i>Agreeableness</i>	Quickly and confidently asserts own rights; irritable; manipulative; uncooperative; rude	Agrees with others about political opinions; good-natured; forgiving; gullible; helpful; forgiving
<i>Neuroticism</i>	Not getting irritated by small annoyances; calm, unemotional; hardy; secure; self-satisfied	Constantly worrying about little things; insecure; hypochondriacal; feeling inadequate

Figure 3. Example behaviors for those scoring low and high for the big 5 traits

Scores on the Big Five traits are mostly independent. That means that a person's standing on one trait tells very little about their standing on the other traits of the Big Five. For example, a person can be extremely high in Extraversion and be either high or low on Neuroticism. Similarly, a person can be low in Agreeableness and be either high or low in Conscientiousness. Thus, in the Five-Factor Model, you need five scores to describe most of an individual's personality.

In the Appendix to this module, we present a short scale to assess the Five-Factor Model of personality (**Donnellan, Oswald, Baird, & Lucas, 2006**). You can take this test to see where you stand in terms of your Big Five scores. John Johnson has also created a helpful website that has personality scales that can be used and taken by the general public:

<http://www.personal.psu.edu/j5j/IPIP/ipipneo120.htm>

After seeing your scores, you can judge for yourself whether you think such tests are valid.

Traits are important and interesting because they describe stable patterns of behavior that persist for long periods of time (**Caspi, Roberts, & Shiner, 2005**). Importantly, these stable patterns can have broad-ranging consequences for many areas of our life (**Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007**). For instance, think about the factors that determine success in college. If you were asked to guess what factors predict good grades in college, you might guess something like intelligence. This guess would be correct, but we know much more about who is likely to do well. Specifically, personality researchers have also found the personality traits like Conscientiousness play an important role in college and beyond, probably because highly conscientious individuals study hard, get their work done on time, and are less distracted by nonessential activities that take time away from school work. In addition, highly conscientious people are often healthier than people low in conscientiousness because they are more likely to maintain healthy diets, to exercise, and to follow basic safety procedures like wearing seat belts or bicycle helmets. Over the long term, this consistent pattern of behaviors can add up to meaningful differences in health and longevity. Thus, personality traits are not just a useful way to describe people you know; they actually help psychologists predict how good a worker someone will be, how long he or she will live, and the types of jobs and activities the person will enjoy. Thus, there is growing interest in personality psychology among psychologists who work in applied settings, such as health psychology or organizational psychology.

Facets of Traits (Subtraits)

So how does it feel to be told that your entire personality can be summarized with scores on just five personality traits? Do you think these five scores capture the complexity of your own

and others' characteristic patterns of thoughts, feelings, and behaviors? Most people would probably say no, pointing to some exception in their behavior that goes against the general pattern that others might see. For instance, you may know people who are warm and friendly and find it easy to talk with strangers at a party yet are terrified if they have to perform in front of others or speak to large groups of people. The fact that there are different ways of being extraverted or conscientious shows that there is value in considering lower-level units of personality that are more specific than the Big Five traits. These more specific, lower-level units of personality are often called **facets**.

Trait	Facets of Trait
<i>Openness</i>	<ul style="list-style-type: none">• Fantasy prone• Open to feelings• Open to diverse behaviors• Open to new and different ideas• Open to various values and beliefs
<i>Conscientiousness</i>	<ul style="list-style-type: none">• Competent• Orderly• Dutiful• Achievement oriented• Self-disciplined• Deliberate
<i>Extraversion</i>	<ul style="list-style-type: none">• Gregarious (sociable)• Warm• Assertive• Active• Excitement-seeking• Positive emotionality
<i>Agreeableness</i>	<ul style="list-style-type: none">• Trusting• Straightforward• Altruistic• Compliant• Modest• Tender-minded
<i>Neuroticism</i>	<ul style="list-style-type: none">• Anxious• Angry• Depressed• Self-consciousness• Impulsive• Vulnerable

Figure 4. Facets of Traits

To give you a sense of what these narrow units are like, Figure 4 shows facets for each of the Big Five traits. It is important to note that although personality researchers generally agree about the value of the Big Five traits as a way to summarize one's personality, there is no widely accepted list of facets that should be studied. The list seen here, based on work by researchers Paul Costa and Jeff McCrae, thus reflects just one possible list among many. It should, however, give you an idea of some of the facets making up each of the Five-Factor Model.

Facets can be useful because they provide more

specific descriptions of what a person is like. For instance, if we take our friend who loves parties but hates public speaking, we might say that this person scores high on the “gregariousness” and “warmth” facets of extraversion, while scoring lower on facets such as “assertiveness” or “excitement-seeking.” This precise profile of facet scores not only provides a better description, it might also allow us to better predict how this friend will do in a variety of different jobs (for example, jobs that require public speaking versus jobs that involve one-on-one interactions with customers; **Paunonen & Ashton, 2001**). Because different facets within a broad, global trait like extraversion tend to go together (those who are gregarious are often but not always assertive), the broad trait often provides a useful summary of what a person is like. But when we really want to know a person, facet scores add to our knowledge in important ways.

Other Traits Beyond the Five-Factor Model

Despite the popularity of the Five-Factor Model, it is certainly not the only model that exists. Some suggest that there are more than five major traits, or perhaps even fewer. For example, in one of the first comprehensive models to be proposed, Hans Eysenck suggested that Extraversion and Neuroticism are most important. Eysenck believed that by combining people’s standing on these two major traits, we could account for many of the differences in personality that we see in people (**Eysenck, 1981**). So for instance, a neurotic introvert would be shy and nervous, while a stable introvert might avoid social situations and prefer solitary activities, but he may do so with a calm, steady attitude and little anxiety or emotion. Interestingly, Eysenck attempted to link these two major dimensions to underlying differences in people’s biology. For instance, he suggested that introverts experienced too

much sensory stimulation and arousal, which made them want to seek out quiet settings and less stimulating environments. More recently, Jeffrey Gray suggested that these two broad traits are related to fundamental reward and avoidance systems in the brain—extraverts might be motivated to seek reward and thus exhibit assertive, reward-seeking behavior, whereas people high in neuroticism might be motivated to avoid punishment and thus may experience anxiety as a result of their heightened awareness of the threats in the world around them (**Gray, 1981**). This model has since been updated; see **Gray & McNaughton, 2000**). These early theories have led to a burgeoning interest in identifying the physiological underpinnings of the individual differences that we observe.

Another revision of the Big Five is the **HEXACO model** of traits (**Ashton & Lee, 2007**). This model is similar to the Big Five, but it posits slightly different versions of some of the traits, and its proponents argue that one important class of individual differences was omitted from the Five-Factor Model. The HEXACO adds Honesty-Humility as a sixth dimension of personality. People high in this trait are sincere, fair, and modest, whereas those low in the trait are manipulative, narcissistic, and self-centered. Thus, trait theorists are agreed that personality traits are important in understanding behavior, but there are still debates on the exact number and composition of the traits that are most important.

There are other important traits that are not included in comprehensive models like the Big Five. Although the five factors capture much that is important about personality, researchers have suggested other traits that capture interesting aspects of our behavior. In Figure 5 below we present just a few, out of hundreds, of the other traits that have been studied by personologists.

Personality Trait	Description
<i>Machiavellianism</i>	Named after the famous political philosopher, Niccolo Machiavelli, this trait refers to individuals who manipulate the behavior of others, often through duplicity. Machiavellians are often interested in money and power, and pragmatically use others in this quest.
<i>Need for Achievement</i>	Those high in need for achievement want to accomplish a lot and set high standards of excellence for themselves. They are able to work persistently and hard for distant goals. David McClelland argued that economic growth depends in part on citizens with high need for achievement.
<i>Need for Cognition</i>	People high in need for cognition find it rewarding to understand things, and are willing to use considerable cognitive effort in this quest. Such individuals enjoy learning, and the process of trying to understand new things.
<i>Authoritarianism</i>	Authoritarians believe in strict social hierarchies, in which they are totally obedient to those above them, and expect complete obedience from their subordinates. Rigid in adherence to rules, the authoritarian personality is very uncomfortable with uncertainty.
<i>Narcissism</i>	The narcissistic personality has self-love that is so strong that it results in high levels of vanity, conceit, and selfishness. The narcissistic individual often has problems feeling empathetic toward others and grateful to others.
<i>Self-esteem</i>	The tendency to evaluate oneself positively. Self-esteem does not imply that one believes that he or she is better than others, only that he or she is a person of worth.
<i>Optimism</i>	The tendency to expect positive outcomes in the future. People who are optimistic expect good things to happen, and indeed they often have more positive outcomes, perhaps because they work harder to achieve them.
<i>Alexithymia</i>	The inability to recognize and label emotions in oneself. The individual also has a difficult time recognizing emotions in others, and often has difficulties in relationships.

Figure 5. Other Traits Beyond Those Included in the Big Five

Not all of the above traits are currently popular with scientists, yet each of them has experienced popularity in the past. Although the Five-Factor Model has been the target of more rigorous research than some of the traits above, these

additional personality characteristics give a good idea of the wide range of behaviors and attitudes that traits can cover.

The Person-Situation Debate and Alternatives to the Trait Perspective

The ideas described in this module should probably seem familiar, if not obvious to you. When asked to think about what our friends, enemies, family members, and colleagues are like, some of the first things that come to mind are their personality characteristics. We might think about how warm and helpful our first teacher was, how irresponsible and careless our brother is, or how demanding and insulting our first boss was. Each of these descriptors reflects a personality trait, and most of us generally think that the descriptions that we use for individuals accurately reflect their “characteristic pattern of thoughts, feelings, and behaviors,” or in other words, their personality.



The way people behave is only in part a product of their natural personality. Situations also influence how a person behaves. Are you for instance a “different person” as a student in a classroom compared to when you’re a member of a close-knit social group? [Image: UO Education, <https://goo.gl/yIgv9T>, CC BY-NC 2.0, <https://goo.gl/VnKlK8>]

But what if this idea were wrong? What if our belief in personality traits were an illusion and people are not consistent from one situation to the next? This was a possibility that shook the foundation of personality psychology in the late 1960s

when Walter Mischel published a book called *Personality and Assessment* (1968). In this book, Mischel suggested that if one looks closely at people's behavior across many different situations, the consistency is really not that impressive. In other words, children who cheat on tests at school may steadfastly follow all rules when playing games and may never tell a lie to their parents. In other words, he suggested, there may not be any general trait of honesty that links these seemingly related behaviors. Furthermore, Mischel suggested that observers may believe that broad personality traits like honesty exist, when in fact, this belief is an illusion. The debate that followed the publication of Mischel's book was called the **person-situation debate** because it pitted the power of personality against the power of situational factors as determinants of the behavior that people exhibit.

Because of the findings that Mischel emphasized, many psychologists focused on an alternative to the trait perspective. Instead of studying broad, context-free descriptions, like the trait terms we've described so far, Mischel thought that psychologists should focus on people's distinctive reactions to specific situations. For instance, although there may not be a broad and general trait of honesty, some children may be especially likely to cheat on a test when the risk of being caught is low and the rewards for cheating are high. Others might be motivated by the sense of risk involved in cheating and may do so even when the rewards are not very high. Thus, the behavior itself results from the child's unique evaluation of the risks and rewards present at that moment, along with her evaluation of her abilities and values. Because of this, the same child might act very differently in different situations. Thus, Mischel thought that specific behaviors were driven by the interaction between very specific, psychologically meaningful features of the situation in which people found themselves, the person's unique way of perceiving that situation, and his or her abilities for dealing with it. Mischel and others argued that

it was these social-cognitive processes that underlie people's reactions to specific situations that provide some consistency when situational features are the same. If so, then studying these broad traits might be more fruitful than cataloging and measuring narrow, context-free traits like Extraversion or Neuroticism.

In the years after the publication of Mischel's (1968) book, debates raged about whether personality truly exists, and if so, how it should be studied. And, as is often the case, it turns out that a more moderate middle ground than what the situationists proposed could be reached. It is certainly true, as Mischel pointed out, that a person's behavior in one specific situation is not a good guide to how that person will behave in a very different specific situation. Someone who is extremely talkative at one specific party may sometimes be reticent to speak up during class and may even act like a wallflower at a different party. But this does not mean that personality does not exist, nor does it mean that people's behavior is completely determined by situational factors. Indeed, research conducted after the person-situation debate shows that on average, the effect of the "situation" is about as large as that of personality traits. However, it is also true that if psychologists assess a broad range of behaviors across many different situations, there are general tendencies that emerge. Personality traits give an indication about how people will act on average, but frequently they are not so good at predicting how a person will act in a specific situation at a certain moment in time. Thus, to best capture broad traits, one must assess *aggregate* behaviors, averaged over time and across many different types of situations. Most modern personality researchers agree that there is a place for broad personality traits and for the narrower units such as those studied by Walter Mischel.

Appendix

The Mini-IPIP Scale

(Donnellan, Oswald, Baird, & Lucas, 2006)

Instructions: Below are phrases describing people's behaviors. Please use the rating scale below to describe how accurately each statement describes you. Describe yourself as you generally are now, not as you wish to be in the future. Describe yourself as you honestly see yourself, in relation to other people you know of the same sex as you are, and roughly your same age. Please read each statement carefully, and put a number from 1 to 5 next to it to describe how accurately the statement describes you.

1 = Very inaccurate

2 = Moderately inaccurate

3 = Neither inaccurate nor accurate

4 = Moderately accurate

5 = Very accurate

1. _____ Am the life of the party (E)
2. _____ Sympathize with others' feelings (A)
3. _____ Get chores done right away (C)
4. _____ Have frequent mood swings (N)
5. _____ Have a vivid imagination (O)
6. _____ Don't talk a lot (E)
7. _____ Am not interested in other people's problems (A)
8. _____ Often forget to put things back in their proper place (C)
9. _____ Am relaxed most of the time (N)
10. _____ Am not interested in abstract ideas (O)
11. _____ Talk to a lot of different people at parties (E)
12. _____ Feel others' emotions (A)
13. _____ Like order (C)

14. _____ Get upset easily (N)
15. _____ Have difficulty understanding abstract ideas (O)
16. _____ Keep in the background (E)
17. _____ Am not really interested in others (A)
18. _____ Make a mess of things (C)
19. _____ Seldom feel blue (N)
20. _____ Do not have a good imagination (O)

Scoring: The first thing you must do is to reverse the items that are worded in the opposite direction. In order to do this, subtract the number you put for that item from 6. So if you put a 4, for instance, it will become a 2. Cross out the score you put when you took the scale, and put the new number in representing your score subtracted from the number 6.

Items to be reversed in this way: 6, 7, 8, 9, 10, 15, 16, 17, 18, 19, 20

Next, you need to add up the scores for each of the five OCEAN scales (including the reversed numbers where relevant). Each OCEAN score will be the sum of four items. Place the sum next to each scale below.

_____ Openness: Add items 5, 10, 15, 20

_____ Conscientiousness: Add items 3, 8, 13, 18

_____ Extraversion: Add items 1, 6, 11, 16

_____ Agreeableness: Add items 2, 7, 12, 17

_____ Neuroticism: Add items 4, 9, 14, 19

Compare your scores to the norms below to see where you stand on each scale. If you are low on a trait, it means you are the opposite of the trait label. For example, low on Extraversion is Introversion, low on Openness is Conventional, and low on Agreeableness is Assertive.

19–20 Extremely High, 17–18 Very High, 14–16 High,

11–13 Neither high nor low; in the middle, 8–10 Low, 6–7 Very low, 4–5 Extremely low

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Agreeableness

A personality trait that reflects a person's tendency to be compassionate, cooperative, warm, and caring to others. People low in agreeableness tend to be rude, hostile, and to pursue their own interests over those of others.

Conscientiousness

A personality trait that reflects a person's tendency to be careful, organized, hardworking, and to follow rules.

Continuous distributions

Characteristics can go from low to high, with all different intermediate values possible. One does not simply have the trait or not have it, but can possess varying amounts of it.

Extraversion

A personality trait that reflects a person's tendency to be sociable, outgoing, active, and assertive.

Facets

Broad personality traits can be broken down into narrower

facets or aspects of the trait. For example, extraversion has several facets, such as sociability, dominance, risk-taking and so forth.

Factor analysis

A statistical technique for grouping similar things together according to how highly they are associated.

Five-Factor Model

(also called the Big Five) The Five-Factor Model is a widely accepted model of personality traits. Advocates of the model believe that much of the variability in people's thoughts, feelings, and behaviors can be summarized with five broad traits. These five traits are Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism.

HEXACO model

The HEXACO model is an alternative to the Five-Factor Model. The HEXACO model includes six traits, five of which are variants of the traits included in the Big Five (Emotionality [E], Extraversion [X], Agreeableness [A], Conscientiousness [C], and Openness [O]). The sixth factor, Honesty-Humility [H], is unique to this model.

Independent

Two characteristics or traits are separate from one another— a person can be high on one and low on the other, or vice-versa. Some correlated traits are relatively independent in that although there is a tendency for a person high on one to also be high on the other, this is not always the case.

Lexical hypothesis

The lexical hypothesis is the idea that the most important differences between people will be encoded in the language that we use to describe people. Therefore, if we

want to know which personality traits are most important, we can look to the language that people use to describe themselves and others.

Neuroticism

A personality trait that reflects the tendency to be interpersonally sensitive and the tendency to experience negative emotions like anxiety, fear, sadness, and anger.

Openness to Experience

A personality trait that reflects a person's tendency to seek out and to appreciate new things, including thoughts, feelings, values, and experiences.

Personality

Enduring predispositions that characterize a person, such as styles of thought, feelings and behavior.

Personality traits

Enduring dispositions in behavior that show differences across individuals, and which tend to characterize the person across varying types of situations.

Person-situation debate

The person-situation debate is a historical debate about the relative power of personality traits as compared to situational influences on behavior. The situationist critique, which started the person-situation debate, suggested that people overestimate the extent to which personality traits are consistent across situations.

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62. Personality, Stability, and Change

Original chapter by M. Brent Donnellan
adapted by the Queen's University
Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

This module describes different ways to address questions about personality stability across the lifespan. Definitions of the major types of personality stability are provided, and evidence concerning the different kinds of stability and change are reviewed. The mechanisms thought to produce personality stability and personality change are identified and explained.

Learning Objectives

- Define heterotypic stability, homotypic stability, absolute stability, and differential stability.
- Describe evidence concerning the absolute and differential stability of personality attributes across the lifespan.
- Explain the maturity, cumulative continuity, and

corresponsive principles of personality development.

- Explain person-environment transactions, and distinguish between active, reactive, and evocative person-environment transactions.
- Identify the four processes that promote personality stability (attraction, selection, manipulation, and attrition). Provide examples of these processes.
- Describe the mechanisms behind the possibility of personality transformation.

Introduction



How much of your personality was determined as a child? How much of it developed as you aged? What aspects of yourself are you thankful to have "grown out of?"
[Image: Ah Wei, <https://goo.gl/nD3y7q>, CC BY-SA 2.0, <https://goo.gl/rxiUsF>]

Personality psychology is about how individuals differ from each other in their characteristic ways of thinking, feeling, and behaving. Some of the most interesting questions about personality attributes involve issues of stability and change. Are shy children destined to become shy adults? Are the typical personality attributes of adults different from the typical attributes of adolescents? Do people

become more self-controlled and better able to manage their negative emotions as they become adults? What mechanisms explain personality stability and what mechanisms account for personality change?

Defining Different Kinds of Personality Stability

Something frustrating happens when you attempt to learn about personality stability[1]: As with many topics in psychology, there are a number of different ways to conceptualize and quantify personality stability (e.g., **Caspi & Bem, 1990; Roberts, Wood, & Caspi, 2008**). This means there are multiple ways to consider questions about personality stability. Thus, the simple (and obviously frustrating) way to respond to most blanket questions about personality stability is to simply answer that it depends on what one means by personality stability. To provide a more satisfying answer to questions about stability, I will first describe the different ways psychologists conceptualize and evaluate personality stability. I will make an important distinction between heterotypic and homotypic stability. I will then describe absolute and differential stability, two ways of considering homotypic stability. I will also draw your attention to the important concept of individual differences in personality development.

Heterotypic stability refers to the psychological coherence of an individual's thoughts, feelings, and behaviors across development. Questions about heterotypic stability concern the degree of consistency in underlying personality attributes. The tricky part of studying heterotypic stability is that the underlying psychological attribute can have different behavioral expressions at different ages. (You may already know that the prefix "hetero" means something like "different" in Greek.) Shyness is a good example of such an attribute because shyness is expressed differently by toddlers and young children than adults. The shy toddler might cling to a caregiver in a crowded setting and burst into tears when separated from this caregiver. The shy adult, on the other hand, may avoid making eye contact with strangers and seem aloof and distant

at social gatherings. It would be highly unusual to observe an adult burst into tears in a crowded setting. The observable behaviors typically associated with shyness “look” different at different ages. Researchers can study heterotypic continuity only once they have a theory that specifies the different behavioral manifestations of the psychological attribute at different points in the lifespan. As it stands, there is evidence that attributes such as shyness and aggression exhibit heterotypic stability across the lifespan (**Caspi, Bem, & Elder, 1989**). Individuals who act shy as children often act shy as adults, but the degree of correspondence is far from perfect because many things can intervene between childhood and adulthood to alter how an individual develops. Nonetheless, the important point is that the patterns of behavior observed in childhood sometimes foreshadow adult personality attributes.

Homotypic stability concerns the amount of similarity in the same observable personality characteristics across time. (The prefix “homo” means something like the “same” in Greek.) For example, researchers might ask whether **stress reaction** or the tendency to become easily distressed by the normal challenges of life exhibits homotypic stability from age 25 to age 45. The assumption is that this attribute has the same manifestations at these different ages. Researchers make further distinctions between absolute stability and differential stability when considering homotypic stability.

Absolute stability refers to the consistency of the level of the same personality attribute across time. If an individual received a score of 45 on a hypothetical measure of stress reaction at age 20 and at age 40, researchers would conclude there was evidence of absolute stability. Questions about absolute stability can be considered at the **group level** or the **individual level**. At the group level, it is common for personality researchers to



When considering personality stability, researchers can think of it at the individual level (e.g., how is 18-year-old you different than 38-year-old you?) or at the group level (e.g., how are most 18-year-olds different than most 38-year-olds?). [Image: Ken Wytock, <https://goo.gl/G1qfcO>, CC BY-NC 2.0, <https://goo.gl/VnKlK8>]

compare average scores on personality measures for groups of different ages. For example, it is possible to investigate whether the average 40-year-old adult has a lower (or higher) level of stress reaction than the average 20-year-old. The answer to this question would tell researchers something about typical patterns of personality development.

It is important to consider absolute stability from both the group and individual perspectives. The individual level is interesting because different people might have different patterns of absolute change over time. One person might report consistently low levels of stress reaction throughout adulthood, whereas another person may report dramatic increases in stress reaction during her 30s and 40s. These different individual patterns can be present even if the overall trend is for a decline in stress reaction with age. Personality psychology is about individual differences and whether an individual's attributes change or remain the same across time might be an important individual difference. Indeed, there are intriguing hints that the rate and direction of change in

characteristics such as stress reaction (or neuroticism) predicts mortality (**Mroczek & Spiro, 2007**).

Differential stability refers to the consistency of a personality attribute in terms of an individual's rank-ordering. A typical question about differential stability might be whether a 20-year-old who is low in stress reaction relative to her same aged peers develops into a 40-year-old who is also low in stress reaction compared to her peers. Differential stability is often interesting because many psychological attributes show average changes across the lifespan. Regardless of average changes with age, however, it is common to assume that more trait-like attributes have a high degree of differential stability. Consider athletic performance as an attribute that may exhibit differential stability. The average 35-year-old is likely to run a 5K race faster than the average 55-year-old. Nonetheless, individuals who are fast relative to their peers in their 30s might also be fast relative to their peers in their 50s. Likewise, even if most people decline on a stress reaction as they age, it is still useful to investigate whether there is consistency over time in their relative standing on this attribute.

Basic Findings about Absolute and Differential Stability

Absolute Stability. There are two common ways to investigate average levels of personality attributes at different ages. The simplest approach is to conduct a **cross-sectional study** and compare different age groups on a given attribute assessed at the same time. For instance, researchers might collect data from a sample of individuals ranging in age from 18 to 99 years and compare stress reaction scores for groups of different ages. A more complicated design involves following the same group of individuals and assessing their personalities at multiple time

points (often two). This is a **longitudinal study**, and it is a much better way to study personality stability than a cross-sectional study. If all of the individuals in the sample are roughly the same age at the start of the study, they would all be considered members of the same **birth cohort**. One of the chief drawbacks of a cross-sectional study is that individuals who are of different ages are *also* members of different birth cohorts. Thus, researchers have no way of knowing whether any personality differences observed in a cross-sectional study are attributable to the influence of age *per se* or birth cohort. A longitudinal study is better able to isolate **age effects** (i.e., differences in personality related to maturation and development) from **cohort effects** (i.e., differences in personality related to being born at a particular point in history) than a cross-sectional study. Cohort is a constant (i.e., an unchanging value) in a longitudinal study when all participants start the study at roughly the same age.

A number of large-scale, cross-sectional studies have evaluated age differences in personality (Anusic, Lucas, & Donnellan, 2012; Lucas & Donnellan, 2009; McCrae & Costa, 2003; Soto, John, Gosling, & Potter, 2011; Srivastava, John, Gosling, & Potter, 2003) as have a number of longitudinal studies (Lucas & Donnellan, 2011; Specht, Egloff, & Schmukle, 2011; Terracciano, McCrae, Brant, & Costa, 2005; Wortman, Lucas, & Donnellan, *in press*). Fortunately, many of the general trends from these different designs converge on the same basic set of findings. Most notably, Roberts, Walton, and Viechtbauer (2006) combined the results of 92 longitudinal studies to provide an overview of absolute changes in personality across the lifespan. They used the Big Five taxonomy (e.g., John, Naumann, & Soto, 2008) to categorize the different personality attributes examined in the individual studies to make sense of the vast literature.

Big 5 Personality Traits (OCEAN)

- Openness
- Conscientiousness
- Extraversion
- Agreeableness
- Neuroticism

*If you're curious where you rank on the Big Five Domains, head to "Psychology Today's" website to take the test for yourself:
<https://goo.gl/aQTqoD>*

The Big Five domains include extraversion (attributes such as assertive, confident, independent, outgoing, and sociable), agreeableness (attributes such as cooperative, kind, modest, and trusting), conscientiousness (attributes such as hard working, dutiful, self-controlled, and goal-oriented), neuroticism (attributes such as anxious, tense, moody, and easily angered), and openness

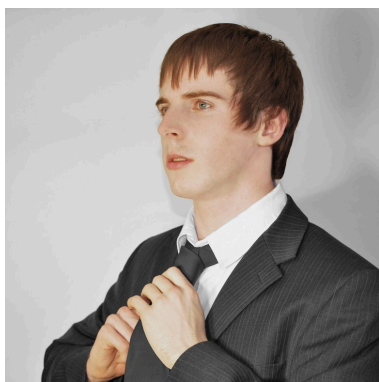
(attributes such as artistic, curious, inventive, and open-minded). The Big Five is one of the most common ways of organizing the vast range of personality attributes that seem to distinguish one person from the next. This organizing framework made it possible for Roberts et al. (2006) to draw broad conclusions from the literature.

In general, average levels of extraversion (especially the attributes linked to self-confidence and independence), agreeableness, and conscientiousness appear to increase with age whereas neuroticism appears to decrease with age (Roberts et al., 2006). Openness also declines with age, especially after mid-life (Roberts et al., 2006). These changes are often viewed as positive trends given that higher levels of agreeableness and conscientiousness and lower levels of neuroticism are associated with seemingly desirable outcomes such as increased relationship stability and quality, greater success at work, better health, a reduced risk of criminality and mental health problems, and even decreased mortality (e.g., Kotov, Gamez, Schmidt, & Watson, 2010; Miller & Lynam 2001; Ozer & Benet-Martínez, 2006; Roberts, Kuncel, Shiner,

Caspi, & Goldberg, 2007). This pattern of positive average changes in personality attributes is known as the **maturity principle of adult personality development (Caspi, Roberts, & Shiner, 2005)**. The basic idea is that attributes associated with positive adaptation and attributes associated with the successful fulfillment of adult roles tend to increase during adulthood in terms of their average levels.

Beyond providing insights into the general outline of adult personality development, Roberts et al. **(2006)** found that young adulthood (the period between the ages of 18 and the late 20s) was the most active time in the lifespan for observing average changes, although average differences in personality attributes were observed across the lifespan. Such a result might be surprising in light of the intuition that adolescence is a time of personality change and maturation. However, young adulthood is typically a time in the lifespan that includes a number of life changes in terms of finishing school, starting a career, committing to romantic partnerships, and parenthood **(Donnellan, Conger, & Burzette, 2007; Rindfuss, 1991)**. Finding that young adulthood is an active time for personality development provides circumstantial evidence that adult roles might generate pressures for certain patterns of personality development. Indeed, this is one potential explanation for the maturity principle of personality development.

It should be emphasized again that average trends are summaries that do not necessarily apply to all individuals. Some people do not conform to the maturity principle. The possibility of exceptions to general trends is the reason it is necessary to study individual patterns of personality development. The methods for this kind of research are becoming increasingly popular (e.g., Vaidya, Gray, Haig, Mroczek, & Watson, 2008) and existing studies suggest that



The maturity principle of adult personality development states that as we age we adjust our traits to fit with our new, adult responsibilities. [Image: Alex France, <https://goo.gl/h12CM3>, CC BY-SA 3.0, <https://goo.gl/eLCn2O>]

personality changes differ across people (Roberts & Mroczek, 2008). These new research methods work best when researchers collect more than two waves of longitudinal data covering longer spans of time. This kind of research design is still somewhat uncommon in psychological studies but it will likely characterize the future of research on personality stability.

Differential stability. The evaluation of differential stability requires a longitudinal study. The simplest strategy is to follow a large sample of participants of the same age and measure their personality attributes at two points separated by a meaningful span of time. The researcher then calculates the correlation between scores at the first assessment and scores at the second assessment (a coefficient sometimes called a test-retest correlation or even a stability coefficient). As you know, a correlation coefficient is a numerical summary of the linear association between two variables. Correlations around .1 or $-.1$ are often called “small” associations, whereas correlations

around .50 and $-.50$ (or larger) are often called “large” associations (Cohen, 1988).

Roberts and DelVecchio (2000) summarized 3,217 test-retest correlations for a wide range of personality attributes reported in 152 longitudinal studies. They used statistical methods to equate the different test-retest correlations to a common interval of about seven years. This allowed them to compare results from studies of differing lengths of time because not all studies followed participants for the same interval of time. Roberts and DelVecchio found that differential stability increased with age. The correlations ranged from about .30 for samples involving young children to about .70 for samples involving older adults. Ferguson (2010) updated and replicated this basic pattern. This pattern of increasing stability with age is called the **cumulative continuity principle of personality development** (Caspi et al., 2005). This general pattern holds for both women and men and applies to a wide range of different personality attributes ranging from extraversion to openness and curiosity. It is important to emphasize, however, that the observed correlations are never perfect at any age (i.e., the correlations do not reach 1.0). This indicates that personality changes can occur at any time in the lifespan; it just seems that greater inconsistency is observed in childhood and adolescence than in adulthood.

Key Messages So Far

It is useful to summarize the key ideas of this module so far. The starting point was the realization that there are several different ways to define and measure personality stability. Heterotypic stability refers to the consistency of the underlying psychological attribute that may have different behavioral manifestations at different ages. Homotypic stability, on the other hand, refers to the consistency of the same observable

manifestations of a personality attribute. This type of stability is commonly studied in the current literature, and absolute and differential stability are a focus on many studies. A consideration of the broad literature on personality stability yields two major conclusions.

1. Average levels of personality attributes seem to change in predictable ways across the lifespan in line with maturity principle of personality development. Traits that are correlated with positive outcomes (such as conscientiousness) seem to increase from adolescence to adulthood. This perspective on personality stability is gained from considering absolute stability in the form of average levels of personality attributes at different ages.
2. Personality attributes are relatively enduring attributes that become increasingly consistent during adulthood in line with the cumulative continuity principle. This perspective on stability is gained from considering differential stability in the form of test-retest correlations from longitudinal studies.



It's quite easy to imagine, "Once I'm 30, married, and with a family, I will be that person for the rest of my life." But the research shows that while some traits are stable, others continue to develop and adjust to our new environments. [Image: CC0 Public Domain, <https://goo.gl/m25gce>]

In general, the picture that emerges from the literature is that personality traits are relatively enduring attributes that become more stable from childhood to adulthood. Nonetheless, the stability of personality attributes is not perfect at any period in the lifespan. This is an important conclusion because it challenges two extreme perspectives that have been influential in psychological research. More than 100 years ago, the famous psychologist William James remarked that character (personality) was

"set like plaster" for most people by age 30. This perspective implies near perfect stability of personality in adulthood. In contrast, other psychologists have sometimes denied there was any stability to personality at all. Their perspective is that individual thoughts and feelings are simply responses to transitory situational influences that are unlikely to show much consistency across the lifespan. As discussed so far, current research does not support either of these extreme perspectives. Nonetheless, the existence of some degree of stability raises important questions about the exact processes and mechanisms that produce personality stability (and personality change).

The How and Why of Personality Stability and Change: Different Kinds of Interplay Between Individuals and Their

Environments

Personality stability is the result of the interplay between the individual and her/his environment. Psychologists use the term **person–environment transactions** (e.g., **Roberts et al., 2008**) to capture the mutually transforming interplay between individuals and their contextual circumstances. Several different types of these transactions have been described by psychological researchers. **Active person–environment transactions** occur when individuals seek out certain kinds of environments and experiences that are consistent with their personality characteristics. Risk-taking individuals may spend their leisure time very differently than more cautious individuals. Some prefer extreme sports whereas others prefer less intense experiences. **Reactive person–environment transactions** occur when individuals react differently to the same objective situation because of their personalities. A large social gathering represents a psychologically different context to the highly extraverted person compared with the highly introverted person. **Evocative person–environment transactions** occur whenever individuals draw out or evoke certain kinds of responses from their social environments because of their personality attributes. A warm and secure individual invites different kinds of responses from peers than a cold and aloof individual.

Current researchers make distinctions between the mechanisms likely to produce personality stability and the mechanisms likely to produce changes (**Roberts, 2006; Roberts et al., 2008**). Brent Roberts coined the helpful acronym ASTMA to aid in remembering many of these mechanisms: Attraction (A), selection (S), manipulation (M), and attrition (A) tend to produce personality stability, whereas transformation (T) explains personality change.

Individuals sometimes select careers, friends, social clubs, and lifestyles because of their personality attributes. This is the active process of **attraction**—individuals are attracted to environments because of their personality attributes. Situations that match with our personalities seem to feel “right” (e.g., Cesario, Grant, & Higgins, **2004**). On the flipside of this process, gatekeepers, such as employers, admissions officers, and even potential



Think to your own preference for hobbies and jobs. How do these activities reflect core attributes of your own personality? [Image: Dave Scriven, <https://goo.gl/4g9tCz>, CC BY-NC 2.0, <https://goo.gl/VnKlK8>]

relationship partners, often **select** individuals because of their personalities. Extraverted and outgoing individuals are likely to make better salespeople than quiet individuals who are uncomfortable with social interactions. All in all, certain individuals are “admitted” by gatekeepers into particular kinds of environments because of their personalities. Likewise, individuals with characteristics that are a bad fit with a particular environment may leave such settings or be asked to leave by gatekeepers. A lazy employee will not last long at a demanding job. These examples capture the process of **attrition** (dropping out). The processes of selection and attrition reflect evocative person–environment transactions. Last, individuals can actively **manipulate** their environments to match their personalities. An outgoing person will find ways to introduce more social interactions into the workday, whereas a shy individual may shun the proverbial water cooler to avoid having contact with others.

These four processes of attraction, selection, attrition, and manipulation explain how a kind of matching occurs between

personality attributes and environmental conditions for many individuals. This positive matching typically produces personality consistency because the “press” of the situation reinforces the attributes of the person. This observation is at the core of the **corresponsive principle of personality development** (Caspi et al., 2005; Roberts, Caspi, & Moffitt, 2003). Preexisting personality attributes and environmental contexts work in concert to promote personality continuity. The idea is that environments often reinforce those personality attributes that were partially responsible for the initial environmental conditions in the first place. For example, ambitious and confident individuals might be attracted to and selected for more demanding jobs (Roberts et al., 2003). These kinds of jobs often require drive, dedication, and achievement striving thereby accentuating dispositional tendencies toward ambition and confidence.

Additional considerations related to person–environment transactions may help to further explain personality stability. Individuals gain more autonomy to select their own environment as they transition from childhood to adulthood (Scarr & McCartney, 1983). This might help explain why the differential stability of personality attributes increases from adolescence into adulthood. Reactive and evocative person–environment transactions also facilitate personality stability. The overarching idea is that personality attributes shape how individuals respond to situations and shape the kinds of responses individuals elicit from their environments. These responses and reactions can generate self-fulfilling cycles. For example, aggressive individuals seem to interpret ambiguous social cues as threatening (something called a **hostile attribution bias** or a hostile attribution of intent; see Crick & Dodge, 1996; Orobio de Castro, Veerman, Kooops, Bosch, & Monshouwer, 2002). If a stranger runs into you and you spill your hot coffee all over a clean shirt, how do you interpret the situation? Do you believe the other person was

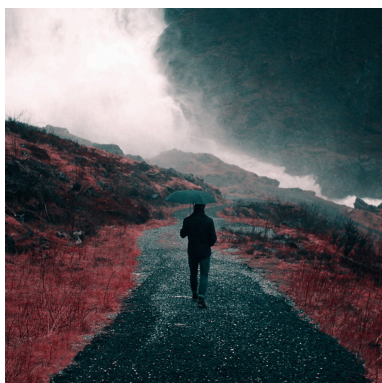
being aggressive, or were you just unlucky? A rude, caustic, or violent response might invite a similar response from the individual who ran into you. The basic point is that personality attributes help shape reactions to and responses from the social world, and these processes often (but not always) end up reinforcing dispositional tendencies.

Although a number of mechanisms account for personality continuity by generating a match between the individual's characteristics and the environment, personality change or **transformation** is nonetheless possible. Recall that differential stability is not perfect. The simplest mechanism for producing change is a cornerstone of behaviorism: Patterns of behavior that produce positive consequences (pleasure) are repeated, whereas patterns of behavior that produce negative consequences (pain) will diminish (**Thorndike, 1933**). Social settings may have the power to transform personality if the individual is exposed to different rewards and punishments and the setting places limitations on how a person can reasonably behave (**Caspi & Moffitt, 1993**). For example, environmental contexts that limit agency and have very clear reward structures such as the military might be particularly powerful contexts for producing lasting personality changes (e.g., **Jackson, Thoemmes, Jonkmann, Lüdke, & Trautwein, 2012**).

It is also possible that individuals might change their personality attributes by actively striving to change their behaviors and emotional reactions with help from outsiders. This idea lies at the heart of psychotherapy. As it stands, the conditions that produce lasting personality changes are an active area of research. Personality researchers have historically sought to demonstrate the existence of personality stability, and they are now turning their full attention to the conditions that facilitate personality change. There are currently a few examples of interventions that end up producing short-term personality changes (**Jackson, Hill, Payne, Roberts, & Stine-**

Morrow, 2012), and this is an exciting area for future research (**Edmonds, Jackson, Fayard, & Roberts, 2008**). Insights about personality change are important for creating effective interventions designed to foster positive human development. Finding ways to promote self-control, emotional stability, creativity, and an agreeable disposition would likely lead to improvements for both individuals and society as a whole because these attributes predict a range of consequential life outcomes (**Ozer & Benet-Martínez, 2006; Roberts et al., 2007**)

Conclusion



Our personality is the result of the self interacting with the environment. Who you are helps to determine what you do and like, and what you do and like helps to determine who you are. [Image: Nick Sheerbart, CC0 Public Domain, <https://goo.gl/m25gce>]

There are multiple ways to evaluate personality stability. The existing evidence suggests that personality attributes are relatively enduring attributes that show predictable average-level changes across the lifespan. Personality stability is produced by a complicated interplay between individuals and their social settings. Many personality attributes are linked to life experiences in a mutually reinforcing cycle: Personality attributes seem to shape

environmental contexts, and those contexts often then accentuate and reinforce those very personality attributes. Even so, personality change or transformation is possible because individuals respond to their environments. Individuals may also want to change their personalities. Personality

researchers are now beginning to address important questions about the possibility of lasting personality changes through intervention efforts.

[1] Throughout most of this module I will use the term stability to refer to continuity, stability/change, and consistency/inconsistency.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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testbookje/?p=779#h5p-327](https://ecampusontario.pressbooks.pub/testbookje/?p=779#h5p-327)

Vocabulary

Absolute stability

Consistency in the level or amount of a personality attribute over time.

Active person–environment transactions

The interplay between individuals and their contextual circumstances that occurs whenever individuals play a key role in seeking out, selecting, or otherwise manipulating aspects of their environment.

Age effects

Differences in personality between groups of different ages that are related to maturation and development instead of birth cohort differences.

Attraction

A connection between personality attributes and aspects of the environment that occurs because individuals with particular traits are drawn to certain environments.

Attrition

A connection between personality attributes and aspects of the environment that occurs because individuals with particular traits drop out from certain environments.

Birth cohort

Individuals born in a particular year or span of time.

Cohort effects

Differences in personality that are related to historical and social factors unique to individuals born in a particular year.

Corresponsive principle

The idea that personality traits often become matched with environmental conditions such that an individual's social context acts to accentuate and reinforce their personality attributes.

Cross-sectional study/design

A research design that uses a group of individuals with different ages (and birth cohorts) assessed at a single point in time.

Cumulative continuity principle

The generalization that personality attributes show increasing stability with age and experience.

Differential stability

Consistency in the rank-ordering of personality across two or more measurement occasions.

Evocative person–environment transactions

The interplay between individuals and their contextual circumstances that occurs whenever attributes of the individual draw out particular responses from others in their environment.

Group level

A focus on summary statistics that apply to aggregates of individuals when studying personality development. An example is considering whether the average score of a group of 50 year olds is higher than the average score of a

group of 21 year olds when considering a trait like conscientiousness.

Heterotypic stability

Consistency in the underlying psychological attribute across development regardless of any changes in how the attribute is expressed at different ages.

Homotypic stability

Consistency of the exact same thoughts, feelings, and behaviors across development.

Hostile attribution bias

The tendency of some individuals to interpret ambiguous social cues and interactions as examples of aggressiveness, disrespect, or antagonism.

Individual level

A focus on individual level statistics that reflect whether individuals show stability or change when studying personality development. An example is evaluating how many individuals increased in conscientiousness versus how many decreased in conscientiousness when considering the transition from adolescence to adulthood.

Longitudinal study/design

A research design that follows the same group of individuals at multiple time points.

Manipulation

A connection between personality attributes and aspects of the environment that occurs whenever individuals with particular traits actively shape their environments.

Maturity principle

The generalization that personality attributes associated with the successful fulfillment of adult roles increase with age and experience.

Person–environment transactions

The interplay between individuals and their contextual circumstances that ends up shaping both personality and the environment.

Reactive person–environment transactions

The interplay between individuals and their contextual circumstances that occurs whenever attributes of the individual shape how a person perceives and responds to their environment.

Selection

A connection between personality attributes and aspects of the environment that occurs whenever individuals with particular attributes choose particular kinds of environments.

Stress reaction

The tendency to become easily distressed by the normal challenges of life.

Transformation

The term for personality changes associated with experience and life events.

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63. Personality Assessment

Original chapter by David Watson adapted by the Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

This module provides a basic overview to the assessment of personality. It discusses objective personality tests (based on both self-report and informant ratings), projective and implicit tests, and behavioral/performance measures. It describes the basic features of each method, as well as reviewing the strengths, weaknesses, and overall validity of each approach.

Learning Objectives

- Appreciate the diversity of methods that are used to measure personality characteristics.
- Understand the logic, strengths and weaknesses of each approach.
- Gain a better sense of the overall validity and range of applications of personality tests.

Introduction

Personality is the field within psychology that studies the thoughts, feelings, behaviors, goals, and interests of normal individuals. It therefore covers a very wide range of important psychological characteristics. Moreover, different theoretical models have generated very different strategies for measuring these characteristics. For example, humanistically oriented models argue that people have clear, well-defined goals and are actively striving to achieve them (**McGregor, McAdams, & Little, 2006**). It, therefore, makes sense to ask them directly about themselves and their goals. In contrast, psychodynamically oriented theories propose that people lack insight into their feelings and motives, such that their behavior is influenced by processes that operate outside of their awareness (e.g., **McClelland, Koestner, & Weinberger, 1989; Meyer & Kurtz, 2006**). Given that people are unaware of these processes, it does not make sense to ask directly about them. One, therefore, needs to adopt an entirely different approach to identify these nonconscious factors. Not surprisingly, researchers have adopted a wide range of approaches to measure important personality characteristics. The most widely used strategies will be summarized in the following sections.



Do people possess the necessary awareness to see themselves as they are and provide accurate insights into their own personalities?
[Image: fotEK10, <https://goo.gl/GCBDJL>, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

Objective Tests

Definition

Objective tests (Loevinger, 1957; Meyer & Kurtz, 2006) represent the most familiar and widely used approach to assessing personality. Objective tests involve administering a standard set of items, each of which is answered using a limited

set of response options (e.g., true or false; strongly disagree, slightly disagree, slightly agree, strongly agree). Responses to these items then are scored in a standardized, predetermined way. For example, self-ratings on items assessing talkativeness, assertiveness, sociability, adventurousness, and energy can be summed up to create an overall score on the personality trait of extraversion.

It must be emphasized that the term “objective” refers to the method that is used to *score* a person’s responses, rather than to the responses themselves. As noted by Meyer and Kurtz (2006, p. 233), “What is *objective* about such a procedure is that the psychologist administering the test does not need to rely on judgment to classify or interpret the test-taker’s response; the intended response is clearly indicated and scored according to a pre-existing key.” In fact, as we will see, a person’s test responses may be highly subjective and can be influenced by a number of different rating biases.

Basic Types of Objective Tests

Self-report measures

Objective personality tests can be further subdivided into two basic types. The first type—which easily is the most widely used in modern personality research—asks people to describe themselves. This approach offers two key advantages. First, self-raters have access to an unparalleled wealth of information: After all, who knows more about you than you yourself? In particular, self-raters have direct access to their own thoughts, feelings, and motives, which may not be readily available to others (Oh, Wang, & Mount, 2011; **Watson, Hubbard, & Weise, 2000**). Second, asking people to describe themselves is the simplest, easiest, and most cost-effective approach to

assessing personality. Countless studies, for instance, have involved administering self-report measures to college students, who are provided some relatively simple incentive (e.g., extra course credit) to participate.

The items included in self-report measures may consist of single words (e.g., *assertive*), short phrases (e.g., *am full of energy*), or complete sentences (e.g., *I like to spend time with others*). Table 1 presents a sample self-report measure assessing the general traits comprising the influential five-factor model (FFM) of personality: neuroticism, extraversion, openness, agreeableness, and conscientiousness (John & Srivastava, 1999; McCrae, Costa, & Martin, 2005). The sentences shown in Table 1 are modified versions of items included in the International Personality Item Pool (IPIP) (Goldberg et al., 2006), which is a rich source of personality-related content in the public domain (for more information about IPIP, go to: <http://ipip.ori.org/>).

Please read each statement carefully and then mark the appropriate response below. Use the following scale to record your responses:

1	2	3	4	5
strongly disagree	slightly disagree	neutral or cannot decide	slightly agree	strongly agree

- | | |
|-------|--|
| ----- | 1. I get upset easily. |
| ----- | 2. I enjoy being part of a group. |
| ----- | 3. I like to solve complex problems. |
| ----- | 4. I believe that others have good intentions. |
| ----- | 5. I am always prepared. |
| ----- | 6. I have a low opinion of myself. |
| ----- | 7. I have a natural talent for influencing people. |
| ----- | 8. I enjoy the beauty of nature. |
| ----- | 9. I try to anticipate the needs of others. |
| ----- | 10. I can be trusted to keep my promises. |
| ----- | 11. I get irritated easily. |
| ----- | 12. I have a lot of fun. |
| ----- | 13. I like to visit new places. |
| ----- | 14. I love to help others. |
| ----- | 15. I set high standards for myself and others. |

Sum up the following items to see how you score on five general personality traits. The numbers below indicate which questions correspond to each trait. A high score indicates a stronger level of that trait:

- | | | | |
|---|----|----|--------------------|
| 1 | 6 | 11 | Neuroticism |
| 2 | 7 | 12 | Extraversion |
| 3 | 8 | 13 | Openness/Intellect |
| 4 | 9 | 14 | Agreeableness |
| 5 | 10 | 15 | Conscientiousness |

Table1: Sample Self-Report Personality Measure

Self-report personality tests show impressive **validity** in relation to a wide range of important outcomes. For example, self-ratings of conscientiousness are significant predictors of both overall academic performance (e.g., cumulative grade point

average; **Poropat, 2009**) and job performance (**Oh, Wang, and Mount, 2011**). Roberts, Kuncel, Shiner, Caspi, and Goldberg (**2007**) reported that self-rated personality predicted occupational attainment, divorce, and mortality. Similarly, Friedman, Kern, and Reynolds (**2010**) showed that personality ratings collected early in life were related to happiness/well-being, physical health, and mortality risk assessed several decades later. Finally, self-reported personality has important and pervasive links to psychopathology. Most notably, self-ratings of neuroticism are associated with a wide array of clinical syndromes, including anxiety disorders, depressive disorders, substance use disorders, somatoform disorders, eating disorders, personality and conduct disorders, and schizophrenia/schizotypy (Kotov, Gamez, Schmidt, & Watson, **2010**; Mineka, Watson, & Clark, **1998**).

At the same time, however, it is clear that this method is limited in a number of ways. First, raters may be motivated to present themselves in an overly favorable, socially desirable way (**Paunonen & LeBel, 2012**). This is a particular concern in “**high-stakes testing**,” that is, situations in which test scores are used to make important decisions about individuals (e.g., when applying for a job). Second, personality ratings reflect a **self-enhancement bias** (**Vazire & Carlson, 2011**); in other words, people are motivated to ignore (or at least downplay) some of their less desirable characteristics and to focus instead on their more positive attributes. Third, self-ratings are subject to the **reference group effect** (**Heine, Buchtel, & Norenzayan, 2008**); that is, we base our self-perceptions, in part, on how we compare to others in our sociocultural reference group. For instance, if you tend to work harder than most of your friends, you will see yourself as someone who is relatively conscientious, even if you are not particularly conscientious in any absolute sense.

Informant ratings

Another approach is to ask someone who knows a person well to describe his or her personality characteristics. In the case of children or adolescents, the informant is most likely to be a parent or teacher. In studies of older participants, informants may be friends, roommates, dating partners, spouses, children, or bosses (Oh et al., 2011; Vazire & Carlson, 2011; Watson et al., 2000).

Generally speaking, informant ratings are similar in format to self-ratings. As was the case with self-report, items may consist of single words, short phrases, or complete sentences. Indeed, many popular instruments include parallel self- and informant-rating versions, and it often is relatively easy to convert a self-report measure so that it can be used to obtain informant ratings. Table 2 illustrates how the self-report instrument shown in Table 1 can be converted to obtain spouse-ratings (in this case, having a husband describe the personality characteristics of his wife).

Please read each statement carefully and then mark the appropriate response below. For each item, select the answer that best represents the personality characteristics of your wife. Use the following scale to record your responses:

1	2	3	4	5
strongly disagree	slightly disagree	neutral or cannot decide	slightly agree	strongly agree

Table 2: Sample Spouse-Report Personality Measure

Informant ratings are particularly valuable when self-ratings are impossible to collect (e.g., when studying young children or cognitively impaired adults) or when their validity is suspect (e.g., as noted earlier, people may not be entirely honest in high-stakes testing situations). They also may be combined with self-ratings of the same characteristics to produce more reliable and valid measures of these attributes (McCrae, 1994).

Informant ratings offer several advantages in comparison to other approaches to assessing personality. A well-acquainted informant presumably has had the opportunity to observe

large samples of behavior in the person he or she is rating. Moreover, these judgments presumably are not subject to the types of defensiveness that potentially can distort self-ratings (**Vazire & Carlson, 2011**). Indeed, informants typically have strong incentives for being accurate in their judgments. As Funder and Dobroth (**1987**, p. 409), put it, “Evaluations of the people in our social environment are central to our decisions about who to befriend and avoid, trust and distrust, hire and fire, and so on.”

Informant personality ratings have demonstrated a level of validity in relation to important life outcomes that is comparable to that discussed earlier for self-ratings. Indeed, they outperform self-ratings in certain circumstances, particularly when the assessed traits are highly evaluative in nature (e.g., intelligence, charm, creativity; see **Vazire & Carlson, 2011**). For example, Oh et al. (**2011**) found that informant ratings were more strongly related to job performance than were self-ratings. Similarly, Oltmanns and Turkheimer (**2009**) summarized evidence indicating that informant ratings of Air Force cadets predicted early, involuntary discharge from the military better than self-ratings.

Nevertheless, informant ratings also are subject to certain problems and limitations. One general issue is the level of relevant information that is available to the rater (**Funder, 2012**). For instance, even under the best of circumstances, informants lack full access to the thoughts, feelings, and motives of the person they are rating. This problem is magnified when the informant does not know the person particularly well and/or only sees him or her in a limited range of situations (**Funder, 2012; Beer & Watson, 2010**).



Informant personality ratings are generally a reliable and valid assessment instrument, however in certain cases the informant may have some significant biases that make the rating less reliable. Newly married individuals for example are likely to rate their partners in an unrealistically positive way. [Image: Sociales El Heraldo de Saltillo, <https://goo.gl/3g3Qhh>, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

Informant ratings also are subject to some of the same response biases noted earlier for self-ratings. For instance, they are not immune to the reference group effect. Indeed, it is well-established that parent ratings often are subject to a **sibling contrast effect**, such that parents exaggerate the true magnitude of differences between their children (Pinto, Rijdsdijk, Frazier-Wood, Asherson, & Kuntsi, 2012). Furthermore, in many studies, individuals are allowed to nominate (or even recruit) the informants who will rate them. Because of this, it most often is the case

that informants (who, as noted earlier, may be friends, relatives, or romantic partners) like the people they are rating. This, in turn, means that informants may produce overly favorable personality ratings. Indeed, their ratings actually can be more favorable than the corresponding self-ratings (**Watson & Humrichouse, 2006**). This tendency for informants to produce unrealistically positive ratings has been termed the **letter of recommendation effect** (Leising, Erbs, & Fritz, 2010) and the **honeymoon effect** when applied to newlyweds (**Watson & Humrichouse, 2006**).

Other Ways of Classifying Objective Tests

Comprehensiveness

In addition to the source of the scores, there are at least two other important dimensions on which personality tests differ. The first such dimension concerns the extent to which an instrument seeks to assess personality in a reasonably comprehensive manner. At one extreme, many widely used measures are designed to assess a single core attribute. Examples of these types of measures include the Toronto Alexithymia Scale (**Bagby, Parker, & Taylor, 1994**), the Rosenberg Self-Esteem Scale (**Rosenberg, 1965**), and the Multidimensional Experiential Avoidance Questionnaire (**Gamez, Chmielewski, Kotov, Ruggero, & Watson, 2011**). At the other extreme, a number of omnibus inventories contain a large number of specific scales and purport to measure personality in a reasonably comprehensive manner. These instruments include the California Psychological Inventory (**Gough, 1987**), the Revised HEXACO Personality Inventory (HEXACO-PI-R) (**Lee & Ashton, 2006**), the Multidimensional Personality Questionnaire (**Patrick, Curtin, & Tellegen, 2002**), the NEO Personality Inventory-3 (NEO-PI-3) (**McCrae et al., 2005**), the Personality Research Form (**Jackson, 1984**), and the Sixteen Personality Factor Questionnaire (**Cattell, Eber, & Tatsuoka, 1980**).

Breadth of the target characteristics

Second, personality characteristics can be classified at different levels of breadth or generality. For example, many models emphasize broad, “big” traits such as neuroticism and

extraversion. These general dimensions can be divided up into several distinct yet empirically correlated component traits. For example, the broad dimension of extraversion contains such specific component traits as dominance (extraverts are assertive, persuasive, and exhibitionistic), sociability (extraverts seek out and enjoy the company of others), positive emotionality (extraverts are active, energetic, cheerful, and enthusiastic), and adventurousness (extraverts enjoy intense, exciting experiences).

Some popular personality instruments are designed to assess only the broad, general traits. For example, similar to the sample instrument displayed in Table 1, the **Big Five Inventory** (John & Srivastava, 1999) contains brief scales assessing the broad traits of neuroticism, extraversion, openness, agreeableness, and conscientiousness. In contrast, many instruments—including several of the omnibus inventories mentioned earlier—were designed primarily to assess a large number of more specific characteristics. Finally, some inventories—including the HEXACO-PI-R and the NEO-PI-3—were explicitly designed to provide coverage of both general and specific trait characteristics. For instance, the NEO-PI-3 contains six specific facet scales (e.g., Gregariousness, Assertiveness, Positive Emotions, Excitement Seeking) that then can be combined to assess the broad trait of extraversion.

Projective and Implicit Tests

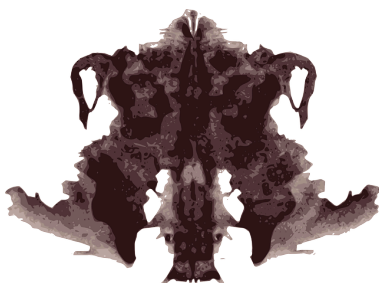
Projective Tests

As noted earlier, some approaches to personality assessment are based on the belief that important thoughts, feelings, and motives operate outside of conscious awareness. Projective tests represent influential early examples of this approach. Projective tests originally were based on the **projective**

hypothesis (Frank, 1939; Lilienfeld, Wood, & Garb, 2000): If a person is

asked to describe or interpret ambiguous stimuli—that is, things that can be understood in a number of different ways—their responses will be influenced by nonconscious needs, feelings, and experiences (note, however, that the theoretical rationale underlying these measures has evolved over time) (see, for example, **Spangler, 1992**). Two prominent examples of projective tests are the Rorschach Inkblot Test (**Rorschach, 1921**) and the Thematic Apperception Test (TAT) (**Morgan & Murray, 1935**). The former asks respondents to interpret symmetrical blots of ink, whereas the latter asks them to generate stories about a series of pictures.

For instance, one TAT picture depicts an elderly woman with her back turned to a young man; the latter looks downward with a somewhat perplexed expression. Another picture



Projective tests, such as the famous Rorschach inkblot test require a person to give spontaneous answers that “project” their unique personality onto an ambiguous stimulus.
[Image: CC0 Public Domain, <https://goo.gl/m25gce>]

displays a man clutched from behind by three mysterious hands. What stories could you generate in response to these pictures?

In comparison to objective tests, projective tests tend to be somewhat cumbersome and labor intensive to administer. The biggest challenge, however, has been to develop a reliable and valid scheme to score the extensive set of responses generated by each respondent. The most widely used Rorschach scoring scheme is the Comprehensive System developed by Exner (2003). The most influential TAT scoring system was developed by McClelland, Atkinson and colleagues between 1947 and 1953 (McClelland et al., 1989; see also Winter, 1998), which can be used to assess motives such as the need for achievement.

The validity of the Rorschach has been a matter of considerable controversy (Lilienfeld et al., 2000; Mihura, Meyer, Dumitrascu, & Bombel, 2012; Society for Personality Assessment, 2005). Most reviews acknowledge that Rorschach scores do show some ability to predict important outcomes. Its critics, however, argue that it fails to provide important incremental information beyond other, more easily acquired information, such as that obtained from standard self-report measures (Lilienfeld et al., 2000).

Validity evidence is more impressive for the TAT. In particular, reviews have concluded that TAT-based measures of the need for achievement (a) show significant validity to predict important criteria and (b) provide important information beyond that obtained from objective measures of this motive (McClelland et al., 1989; Spangler, 1992). Furthermore, given the relatively weak associations between objective and projective measures of motives, McClelland et al. (1989) argue that they tap somewhat different processes, with the latter assessing **implicit motives** (Schultheiss, 2008).

Implicit Tests

In recent years, researchers have begun to use implicit measures of personality (**Back, Schmuckle, & Egloff, 2009; Vazire & Carlson, 2011**). These tests are based on the assumption that people form automatic or implicit associations between certain concepts based on their previous experience and behavior. If two concepts (e.g., *me* and *assertive*) are strongly associated with each other, then they should be sorted together more quickly and easily than two concepts (e.g., *me* and *shy*) that are less strongly associated. Although validity evidence for these measures still is relatively sparse, the results to date are encouraging: Back et al. (**2009**), for example, showed that implicit measures of the FFM personality traits predicted behavior even after controlling for scores on objective measures of these same characteristics.

Behavioral and Performance Measures

A final approach is to infer important personality characteristics from direct samples of behavior. For example, Funder and Colvin (1988) brought opposite-sex pairs of participants into the laboratory and had them engage in a five-minute “getting acquainted” conversation; raters watched videotapes of these interactions and then scored the participants on various personality characteristics. Mehl, Gosling, and Pennebaker (2006) used the



Observing real world behavior is one way to assess personality. Tendencies such as messiness and neatness are clues to personality.
[Image: Crumley Roberts, <https://goo.gl/6Ahn8q>, CC BY 2.0, <https://goo.gl/BRvSA7>]

electronically activated recorder (EAR) to obtain samples of ambient sounds in participants' natural environments over a period of two days; EAR-based scores then were related to self- and observer-rated measures of personality. For instance, more frequent talking over this two-day period was significantly related to both self- and observer-ratings of extraversion. As a final example, Gosling, Ko, Mannarelli, and Morris (2002) sent observers into college students' bedrooms and then had them rate the students' personality characteristics on the Big Five traits. The averaged observer ratings correlated significantly with participants' self-ratings on all five traits. Follow-up analyses indicated that conscientious students had neater rooms, whereas those who were high in openness to experience had a wider variety of books and magazines.

Behavioral measures offer several advantages over other approaches to assessing personality. First, because behavior is

sampled directly, this approach is not subject to the types of response biases (e.g., self-enhancement bias, reference group effect) that can distort scores on objective tests. Second, as is illustrated by the Mehl et al. (2006) and Gosling et al. (2002) studies, this approach allows people to be studied in their daily lives and in their natural environments, thereby avoiding the artificiality of other methods (Mehl et al., 2006). Finally, this is the only approach that actually assesses what people *do*, as opposed to what they think or feel (see Baumeister, Vohs, & Funder, 2007).

At the same time, however, this approach also has some disadvantages. This assessment strategy clearly is much more cumbersome and labor intensive than using objective tests, particularly self-report. Moreover, similar to projective tests, behavioral measures generate a rich set of data that then need to be scored in a reliable and valid way. Finally, even the most ambitious study only obtains relatively small samples of behavior that may provide a somewhat distorted view of a person's true characteristics. For example, your behavior during a "getting acquainted" conversation on a single given day inevitably will reflect a number of transient influences (e.g., level of stress, quality of sleep the previous night) that are idiosyncratic to that day.

Conclusion

No single method of assessing personality is perfect or infallible; each of the major methods has both strengths and limitations. By using a diversity of approaches, researchers can overcome the limitations of any single method and develop a more complete and integrative view of personality.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Big Five

Five, broad general traits that are included in many prominent models of personality. The five traits are

neuroticism (those high on this trait are prone to feeling sad, worried, anxious, and dissatisfied with themselves), extraversion (high scorers are friendly, assertive, outgoing, cheerful, and energetic), openness to experience (those high on this trait are tolerant, intellectually curious, imaginative, and artistic), agreeableness (high scorers are polite, considerate, cooperative, honest, and trusting), and conscientiousness (those high on this trait are responsible, cautious, organized, disciplined, and achievement-oriented).

High-stakes testing

Settings in which test scores are used to make important decisions about individuals. For example, test scores may be used to determine which individuals are admitted into a college or graduate school, or who should be hired for a job. Tests also are used in forensic settings to help determine whether a person is competent to stand trial or fits the legal definition of sanity.

Honeymoon effect

The tendency for newly married individuals to rate their spouses in an unrealistically positive manner. This represents a specific manifestation of the letter of recommendation effect when applied to ratings made by current romantic partners. Moreover, it illustrates the very important role played by relationship satisfaction in ratings made by romantic partners: As marital satisfaction declines (i.e., when the “honeymoon is over”), this effect disappears.

Implicit motives

These are goals that are important to a person, but that they cannot consciously express. Because the individual cannot verbalize these goals directly, they cannot be easily assessed via self-report. However, they can be measured

using projective devices such as the Thematic Apperception Test (TAT).

Letter of recommendation effect

The general tendency for informants in personality studies to rate others in an unrealistically positive manner. This tendency is due a pervasive bias in personality assessment: In the large majority of published studies, informants are individuals who like the person they are rating (e.g., they often are friends or family members) and, therefore, are motivated to depict them in a socially desirable way. The term reflects a similar tendency for academic letters of recommendation to be overly positive and to present the referent in an unrealistically desirable manner.

Projective hypothesis

The theory that when people are confronted with ambiguous stimuli (that is, stimuli that can be interpreted in more than one way), their responses will be influenced by their unconscious thoughts, needs, wishes, and impulses. This, in turn, is based on the Freudian notion of projection, which is the idea that people attribute their own undesirable/unacceptable characteristics to other people or objects.

Reference group effect

The tendency of people to base their self-concept on comparisons with others. For example, if your friends tend to be very smart and successful, you may come to see yourself as less intelligent and successful than you actually are. Informants also are prone to these types of effects. For instance, the sibling contrast effect refers to the tendency of parents to exaggerate the true extent of differences between their children.

Reliability

The consistency of test scores across repeated assessments. For example, test-retest reliability examines the extent to which scores change over time.

Self-enhancement bias

The tendency for people to see and/or present themselves in an overly favorable way. This tendency can take two basic forms: defensiveness (when individuals actually believe they are better than they really are) and impression management (when people intentionally distort their responses to try to convince others that they are better than they really are). Informants also can show enhancement biases. The general form of this bias has been called the letter-of-recommendation effect, which is the tendency of informants who like the person they are rating (e.g., friends, relatives, romantic partners) to describe them in an overly favorable way. In the case of newlyweds, this tendency has been termed the honeymoon effect.

Sibling contrast effect

The tendency of parents to use their perceptions of all of their children as a frame of reference for rating the characteristics of each of them. For example, suppose that a mother has three children; two of these children are very sociable and outgoing, whereas the third is relatively average in sociability. Because of operation of this effect, the mother will rate this third child as less sociable and outgoing than they actually are. More generally, this effect causes parents to exaggerate the true extent of differences between their children. This effect represents a specific manifestation of the more general reference group effect when applied to ratings made by parents.

Validity

Evidence related to the interpretation and use of test scores. A particularly important type of evidence is criterion validity, which involves the ability of a test to predict theoretically relevant outcomes. For example, a presumed measure of conscientiousness should be related to academic achievement (such as overall grade point average).

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PSYC 100 XXIII

SOCIAL THINKING AND PEOPLE IN GROUPS

64. Defining Social Psychology

*Original chapter from Principles of Social Psychology
adapted by the Queen's University Psychology
Department*

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

You'll notice that this chapter looks a bit different from our earlier chapters. A benefit of an Open Access textbook is that we have the ability to source and adapt content written by experts globally that address issues that are important for our course. This chapter is from the text “Principles of Social Psychology.” You can find the book [here](#).

Learning Objectives

- Define *social psychology*.
- Review the history of the field of social psychology and the topics that social psychologists study.
- Summarize the principles of social psychology.
- Describe and provide examples of the person-situation interaction.
- Review the concepts of (a) social norms and (b) cultures.

The field of social psychology is growing rapidly and is having an increasingly important influence on how we think about

human behavior. Newspapers, websites, and other media frequently report the findings of social psychologists, and the results of social psychological research are influencing decisions in a wide variety of areas. Let's begin with a short history of the field of social psychology and then turn to a review of the basic principles of the science of social psychology.

The History of Social Psychology

The science of social psychology began when scientists first started to systematically and formally measure the thoughts, feelings, and behaviors of human beings (**Kruglanski & Stroebe, 2011**). The earliest social psychology experiments on group behavior were conducted before 1900 (**Triplett, 1898**), and the first social psychology textbooks were published in 1908 (McDougall, 1908/2003; Ross, 1908/1974). During the 1940s and 1950s, the social psychologists Kurt Lewin and Leon Festinger refined the experimental approach to studying behavior, creating social psychology as a rigorous scientific discipline. Lewin is sometimes known as “the father of social psychology” because he initially developed many of the important ideas of the discipline, including a focus on the dynamic interactions among people. In 1954, Festinger edited an influential book called *Research Methods in the Behavioral*

Sciences, in which he and other social psychologists stressed the need to measure variables and to use laboratory experiments to systematically test research hypotheses about social behavior. He also noted that it might be necessary in these experiments to deceive the participants about the true nature of the research.

Social psychology was energized by researchers who attempted to understand how the German dictator Adolf Hitler could have produced such extreme obedience and horrendous behaviors in his followers during the Second World War. The studies on conformity conducted by Muzafir Sherif (**1936**) and Solomon Asch (**1952**), as well as those on obedience by Stanley Milgram (**1974**), showed the importance of conformity pressures in social groups and how people in authority could create obedience, even to the extent of leading people to cause severe harm to others. Philip Zimbardo, in his well-known “prison experiment” (**Haney, Banks, & Zimbardo, 1973**), found that ordinary male college students who were recruited to play the roles of guards and prisoners in a simulated prison became so involved in their assignments, and their interaction became so violent, that the study had to be terminated early (Note 1.4 “Video Clip 1”). This research again demonstrated the power of the social setting.

Video Clip 1



One or more interactive elements has been excluded from this version of the text. You can

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(click to see video)

The Stanford prison experiment conducted by Philip Zimbardo in the 1960s demonstrated the powerful role of the social situation on human behavior.

Social psychology quickly expanded to study other topics. John Darley and Bibb Latané (1968) developed a model that helped explain when people do and do not help others in need, and Leonard Berkowitz (1974) pioneered the study of human aggression. Meanwhile, other social psychologists, including Irving Janis (1972), focused on group behavior, studying why intelligent people sometimes made decisions that led to disastrous results when they worked together. Still other social psychologists, including Gordon Allport and Muzafir Sherif, focused on intergroup relations, with the goal of understanding and potentially reducing the occurrence of stereotyping, prejudice, and discrimination. Social psychologists gave their opinions in the 1954 *Brown v. Board of Education* Supreme Court case that helped end racial segregation in U.S. public schools, and social psychologists still

frequently serve as expert witnesses on these and other topics (**Fiske, Bersoff, Borgida, Deaux, & Heilman, 1991**).

The latter part of the 20th century saw an expansion of social psychology into the field of attitudes, with a particular emphasis on cognitive processes. During this time, social psychologists developed the first formal models of persuasion, with the goal of understanding how advertisers and other people could present their messages to make them most effective (**Eagly & Chaiken, 1993; Hovland, Janis, & Kelley, 1963**). These approaches to attitudes focused on the cognitive processes that people use when evaluating messages and on the relationship between attitudes and behavior. Leon Festinger's (1957) important cognitive dissonance theory was developed during this time and became a model for later research.

In the 1970s and 1980s, social psychology became even more cognitive in orientation as social psychologists used advances in cognitive psychology, which were themselves based largely on advances in computer technology, to inform the field (**Fiske & Taylor, 2008**). The focus of these researchers, including Alice Eagly, Susan Fiske, E. Tory Higgins, Richard Nisbett, Lee Ross, Shelley Taylor, and many others, was on **social cognition**—an understanding of how our knowledge about our social worlds develops through experience and the influence of these knowledge structures on memory, information processing, attitudes, and judgment. Furthermore, the extent to which humans' decision making could be flawed by both cognitive and motivational processes was documented (**Kahneman, Slovic, & Tversky, 1982**).

In the 21st century, the field of social psychology has been expanding into still other areas. Examples that we will consider in this book include an interest in how social situations influence our health and happiness, the important roles of evolutionary experiences and cultures on our behavior, and the field of **social neuroscience**—*the study of how our social*

behavior both influences and is influenced by the activities of our brain (Lieberman, 2010). Social psychologists continue to seek new ways to measure and understand social behavior, and the field continues to evolve. I cannot predict where social psychology will be directed in the future, but I have no doubt that it will still be alive and vibrant.

The Person and the Social Situation

Social psychology is the study of the dynamic relationship between individuals and the people around them (see Figure 1.1 “The Person-Situation Interaction”). Each of us is different, and our individual characteristics, including our personality traits, desires, motivations, and emotions, have an important impact on our social behavior. But our behavior is also profoundly influenced by the **social situation**—*the people with whom we interact every day*. These people include our friends and family, our fraternity brothers or sorority sisters, our religious groups, the people we see on TV or read about or interact with on the web, as well as people we think about, remember, or even imagine.

Figure 1.1 The Person-Situation Interaction



Social psychologists believe that human behavior is determined by both a person's characteristics and the social situation. They also believe that the social situation is frequently a stronger influence on behavior than are a person's characteristics.

Social psychology is largely the study of the social situation. Our social situations create **social influence**, the process through which other people change our thoughts, feelings, and behaviors and through which we change theirs. Maybe you can already see how the social influence provided by the members of the Heaven's Gate cult was at work in the Hale-Bopp suicide.

Kurt Lewin formalized the joint influence of person variables and situational variables, which is known as the **person-situation interaction**, in an important equation:

Behavior = f (person, social situation).

Lewin's equation indicates that the behavior of a given person at any given time is a function of (depends on) both the characteristics of the person and the influence of the social situation.

The Social Situation Creates Powerful Social Influence

When people are asked to indicate the things that they value the most, they usually mention their social situation—that is, their relationships with other people (**Baumeister & Leary, 1995; Fiske & Haslam, 1996**). When we work together on a class project, volunteer at a homeless shelter, or serve on a jury in a courtroom trial, we count on others to work with us to get the job done. We develop social bonds with those people, and we expect that they will come through to help us meet our goals. The importance of others shows up in every aspect of our lives—other people teach us what we should and shouldn't do, what we should and shouldn't think, and even what we should and shouldn't like and dislike.

In addition to the people with whom we are currently interacting, we are influenced by people who are not physically present but who are nevertheless part of our thoughts and feelings. Imagine that you are driving home on a deserted country road late at night. No cars are visible in any direction, and you can see for miles. You come to a stop sign. What do you do? Most likely, you stop at the sign, or at least slow down. You do so because the behavior has been internalized: Even though no one is there to watch you, others are still influencing you—you've learned about the rules and laws of society, what's right and what's wrong, and you tend to obey them. We carry our own personal social situations—our experiences with our parents, teachers, leaders, authorities, and friends—around with us every day.

An important principle of social psychology is that although individuals' characteristics do matter, the social situation is often a stronger determinant of behavior than is personality. When social psychologists analyze an event such as a cult suicide, they are likely to focus more on the characteristics of the situation (e.g., the strong leader and the group pressure provided by the other group members) than on the characteristics of the cult members themselves. As an example, we will see that even ordinary people who are neither bad nor evil in any way can nevertheless be placed in situations in which an authority figure is able to lead them to engage in evil behaviors, such as applying potentially lethal levels of electrical shock (**Milgram, 1974**).

In addition to discovering the remarkable extent to which our behavior is influenced by our social situation, social psychologists have discovered that we often do not recognize how important the social situation is in determining behavior. We often wrongly think that we and others act entirely on our own accord, without any external influences. It is tempting to assume that the people who commit extreme acts, such as terrorists or members of suicide cults, are unusual or extreme people. And yet much research suggests that these behaviors are caused more by the social situation than they are by the characteristics of the individuals and that it is wrong to focus so strongly on explanations of individuals' characteristics (**Gilbert & Malone, 1995**).

There is perhaps no clearer example of the powerful influence of the social situation than that found in research showing the enormous role that others play in our physical and mental health. **Social support** *refers to the comfort that we receive from the people around us—for instance, our family, friends, classmates, and coworkers* (**Diener, Suh, Lucas, & Smith, 1999; Diener, Tamir, & Scollon, 2006**).

Social Psychology in the Public Interest

How the Social Situation Influences Our Mental and Physical Health

In comparison with those who do not feel that they have a network of others they can rely on, people who feel that they have adequate social support report being happier and have also been found to have fewer psychological problems, including eating disorders and mental illness (Diener, Suh, Lucas, & Smith, 1999; Diener, Tamir, & Scollon, 2006).

People with social support are less depressed overall, recover faster from negative events, and are less likely to commit suicide (Au, Lau, & Lee, 2009; Bertera, 2007; Compton, Thompson, & Kaslow, 2005; Skärsäter, Langius, Ågren, Hägström, & Dencker, 2005). Married people report being happier than unmarried people (Pew, 2006), and overall, a happy marriage is an excellent form of social support. One of the goals of

effective psychotherapy is to help people generate better social support networks because such relationships have such a positive effect on mental health.

In addition to having better mental health, people who have adequate social support are more physically healthy. They have fewer diseases (such as tuberculosis, heart attacks, and cancer), live longer, have lower blood pressure, and have fewer deaths at all ages (Cohen & Wills, 1985; Stroebe & Stroebe, 1996). Sports psychologists have even found that individuals with higher levels of social support are less likely to be injured playing sports and recover more quickly from injuries they do receive (Hardy, Richman, & Rosenfeld, 1991). These differences appear to be due to the positive effects of social support upon physiological functioning, including the immune system.

The opposite of social support is the feeling of being excluded or ostracized. Feeling that others are excluding us is painful, and the pain of rejection may linger even longer than physical pain. People who were asked to recall an event that caused them social pain (e.g., betrayal by a person very close to them) rated the pain as more intense than they rated their memories of intense physical pain (Chen, Williams, Fitness, & Newton, 2008). When people are threatened with social exclusion, they subsequently express greater interest in making new friends, increase their desire to work cooperatively with others, form more positive first impressions of new potential interaction partners, and even become more able to discriminate between real smiles and fake smiles (Bernstein, Young, Brown, Sacco,

& Claypool, 2008; Maner, DeWall, Baumeister, & Schaller, 2007).

Because connecting with others is such an important part of human experience, we may sometimes withhold affiliation from or ostracize other people in order to attempt to force them to conform to our wishes. When individuals of the Amish religion violate the rulings of an elder, they are placed under a *Meidung*. During this time, and until they make amends, they are not spoken to by community members. And people frequently use the “silent treatment” to express their disapproval of a friend’s or partner’s behavior. The pain of ostracism is particularly strong in adolescents (Sebastian, Viding, Williams, & Blakemore, 2010).

The use of ostracism has also been observed in parents and children, and even in Internet games and chat rooms (Williams, Cheung, & Choi, 2000). The silent treatment and other forms of ostracism are popular because they work. Withholding social communication and interaction is a powerful weapon for punishing individuals and forcing them to change their behaviors. Individuals who are ostracized report feeling alone, frustrated, sad, and unworthy and having lower self-esteem (Bastian & Haslam, 2010).

Taken together, then, social psychological research results suggest that one of the most important things you can do for yourself is to develop a stable support network. Reaching out to other people benefits those who become your friends (because you are in their support network) and has substantial benefits for you.

Social Influence Creates Social Norms

In some cases, social influence occurs rather passively, without any obvious intent of one person to influence the other, such as when we learn about and adopt the beliefs and behaviors of the people around us, often without really being aware that we are doing so. Social influence occurs when a young child adopts the beliefs and values of his or her parents or when we start liking jazz music, without really being aware of it, because our roommate plays a lot of it. In other cases, social influence is anything but subtle; it involves one or more individuals actively attempting to change the beliefs or behaviors of others, as is evident in the attempts of the members of a jury to get a dissenting member to change his or her opinion, the use of a popular sports figure to encourage children to buy products, or the messages that cult leaders give to their followers to encourage them to engage in the behaviors required of the group.

One outcome of social influence is the development of **social norms**—*the ways of thinking, feeling, or behaving that are shared by group members and perceived by them as appropriate* (Asch, 1955; Cialdini, 1993). Norms include customs, traditions, standards, and rules, as well as the general values of the group. Through norms, we learn what people actually do (“people in the United States are more likely to eat scrambled eggs in the morning and spaghetti in the evening, rather than vice versa”) and also what we should do (“do unto others as you would have them do unto you”) and shouldn’t do (“do not make racist jokes”). There are norms about almost

every possible social behavior, and these norms have a big influence on our actions.

Different Cultures Have Different Norms

The social norms that guide our everyday behaviors and that create social influence derive in large part from our **culture**. A culture represents *a group of people, normally living within a given geographical region, who share a common set of social norms, including religious and family values and moral beliefs* (Fiske, Kitayama, Markus, & Nisbett, 1998; Matsumoto, 2001). The culture in which we live affects our thoughts, feelings, and behavior through teaching, imitation, and other forms of social transmission (Mesoudi, 2009). It is not inappropriate to say that our culture defines our lives just as much as our evolutionary experience does.

Cultures differ in terms of the particular norms that they find important and that guide the behavior of the group members. Social psychologists have found that there is a fundamental difference in social norms between Western cultures (including the United States, Canada, Western Europe, Australia, and New Zealand) and East Asian cultures (including China, Japan, Taiwan, Korea, India, and Southeast Asia). Norms in Western cultures are primarily oriented toward **individualism**—*cultural norms, common in Western societies, that focus primarily on*

self-enhancement and independence. Children in Western cultures are taught to develop and value a sense of their personal self and to see themselves as largely separate from the people around them. Children in Western cultures feel special about themselves—they enjoy getting gold stars on their projects and the best grade in the class (**Markus, Mullally, & Kitayama, 1997**). Adults in Western cultures are oriented toward promoting their own individual success, frequently in comparison with (or even at the expense of) others. When asked to describe themselves, individuals in Western cultures generally tend to indicate that they like to “do their own thing,” prefer to live their lives independently, and base their happiness and self-worth upon their own personal achievements. In short, in Western cultures the emphasis is on self-concern.

Norms in the East Asian cultures, on the other hand, are more focused on other-concern. *These norms indicate that people should be more fundamentally connected with others and thus are more oriented toward interdependence, or collectivism*. In East Asian cultures, children are taught to focus on developing harmonious social relationships with others, and the predominant norms relate to group togetherness, connectedness, and duty and responsibility to one’s family. The members of East Asian cultures, when asked to describe themselves, indicate that they are particularly concerned about the interests of others, including their close friends and their colleagues. As one example of these cultural differences, research conducted by Shinobu Kitayama and his colleagues (**Uchida, Norasakkunkit, & Kitayama, 2004**) found that East Asians were more likely than Westerners to experience happiness as a result of their connections with other people, whereas Westerners were more likely to experience happiness as a result of their own personal accomplishments.

People from Western cultures are, on average, more individualistic than people from Eastern cultures, who are, on average, more collectivistic.



Other researchers have studied other cultural differences, such as variations in orientations toward time. Some cultures are more concerned with arriving and departing according to a fixed schedule, whereas others consider time in a more flexible manner (**Levine & Norenzayan, 1999**). Levine and colleagues (1999) found that “the pace of life,” as assessed by average walking speed in downtown locations and the speed with which postal clerks completed a simple request, was fastest in Western countries (but also including Japan) and slowest in economically undeveloped countries. It has also been argued that there are differences in the extent to which people in different cultures are bound by social norms and customs, rather than being free to express their own individuality without regard to considering social norms (**Gelfand et al., 1996**). And there are also cultural differences regarding personal space, such as how close individuals stand to each other when talking, as well as differences in the communication styles individuals employ.

It is important to be aware of cultures and cultural differences, at least in part because people with different cultural backgrounds are increasingly coming into contact with each other as a result of increased travel and immigration and the development of the Internet and other forms of communication. In the United States, for instance, there are many different ethnic groups, and the proportion of the population that comes from minority (non-White) groups is increasing from year to year. Minorities will account for a much larger proportion of the total new entries into the U.S.

workforce over the next decades. In fact, minorities, which are now roughly one third of the U.S. population, are expected to become the majority by 2042, and the United States is expected to be 54% minority by 2050. By 2023, more than half of all children will be minorities (U.S. Census Bureau, n.d.). These changes will result in considerable growth in cultural diversity in the United States, and although this will create the potential for useful cooperation and productive interaction, it may also produce unwanted social conflict. Being aware of cultural differences and considering their influence on how we behave toward others is an important part of a basic understanding of social psychology and a topic that we will return to in a later chapter.

Social Psychology: More than common sense

The science of social psychology addresses many phenomena that we see in every-day life. Sometimes this leads to the false belief that social psychological research is really just “common sense”. In the following video, Dr. David Hauser of Queen’s University explores this false belief, and demonstrates the importance of a scientific approach when studying how people interact with each other and the world around them.



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Key Takeaways

- The history of social psychology includes the study of attitudes, group behavior, altruism and aggression, culture, prejudice, and many other topics.
- Social psychologists study real-world problems using a scientific approach.
- Thinking about your own interpersonal interactions from the point of view of social psychology can help you better understand and respond to them.
- Social psychologists study the person-situation interaction: how characteristics of the person and characteristics of the social situation interact to determine behavior.
- Many human social behaviors have been selected by evolutionary adaptation.
- The social situation creates social norms—shared ways of thinking, feeling, and behaving.
- Cultural differences—for instance, in individualistic versus collectivistic orientations—guide our everyday behavior.

Check Your Knowledge

To help you with your studying, we've included some practice

questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Collectivism

Belief system that emphasizes the duties and obligations that each person has toward others.

Culture

A pattern of shared meaning and behavior among a group of people that is passed from one generation to the next.

Individualism

Belief system that exalts freedom, independence, and individual choice as high values.

Person-situation interaction

The joint influence of person variables and situational variables

Social cognition

The study of how people think about the social world.

Social influence

The process through which other people change our thoughts, feelings, and behaviors and through which we change theirs

Social neuroscience

The study of how our social behavior both influences and is influenced by the activities of our brain

Social norms

The ways of thinking, feeling, or behaving that are shared by group members and perceived by them as appropriate

Social situation

The people with whom we interact every day

Social support

The perception or actuality that we have a social network that can help us in times of need and provide us with a variety of useful resources (e.g., advice, love, money).

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65. Exploring Attitudes and Changing Attitudes Through Persuasion

*Original chapter from Principles of Social Psychology
adapted by the Queen's University Psychology
Department*

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Exploring Attitudes

Learning Objectives

- Define the concept of attitude and explain why it is of such interest to social psychologists.

- Review the variables that determine attitude strength.
- Outline the factors affect the strength of the attitude-behavior relationship.

Although we might use the term in a different way in our everyday life (“Hey, he’s really got an *attitude!*”), social psychologists reserve the term **attitude** to refer to our *relatively enduring evaluation of something*, where the something is called the **attitude object**. The attitude object might be a person, a product, or a social group (Albarracín, Johnson, & Zanna, 2005; Wood & Quinn, 2003). In this section we will consider the nature and strength of attitudes and the conditions under which attitudes best predict our behaviors.

Attitudes Are Evaluations

When we say that attitudes are evaluations, we mean that they involve a preference for or against the attitude object, as commonly expressed in such terms as *prefer, like, dislike, hate, and love*. When we express our attitudes—for instance, when we say, “I love Cheerios,” “I hate snakes,” “I’m crazy about Bill,” or “I like Italians”—we are expressing the relationship (either positive or negative) between the self and an attitude object. Statements such as these make it clear that attitudes are an important part of the self-concept—attitudes tie the self-

concept to the attitude object, and so our attitudes are an essential part of “us.”

Every human being holds thousands of attitudes, including those about family and friends, political parties and political figures, abortion rights and terrorism, preferences for music, and much more. Each of our attitudes has its own unique characteristics, and no two attitudes come to us or influence us in quite the same way. Research has found that some of our attitudes are inherited, at least in part, via genetic transmission from our parents (**Olson, Vernon, Harris, & Jang, 2001**). Other attitudes are learned mostly through direct and indirect experiences with the attitude objects (**De Houwer, Thomas, & Baeyens, 2001**). We may like to ride roller coasters in part because our genetic code has given us a thrill-loving personality and in part because we've had some really great times on roller coasters in the past. Still other attitudes are learned via the media (**Hargreaves & Tiggemann, 2003; Levina, Waldo, & Fitzgerald, 2000**) or through our interactions with friends (**Poteat, 2007**). Some of our attitudes are shared by others (most of us like sugar, fear snakes, and are disgusted by cockroaches), whereas other attitudes—such as our preferences for different styles of music or art—are more individualized.

Table 5.1 “Heritability of Some Attitudes” shows some of the attitudes that have been found to be the most highly heritable (i.e. most strongly determined by genetic variation among people). These attitudes form earlier and are stronger and more resistant to change than others (**Bourgeois, 2002**), although it is not yet known why some attitudes are more genetically determined than are others.

Table 5.1 Heritability of Some Attitudes

Attitude	Heritability
Abortion on demand	0.54
Roller coaster rides	0.52
Death penalty for murder	0.5
Open-door immigration	0.46
Organized religion	0.45
Doing athletic activities	0.44
Voluntary euthanasia	0.44
Capitalism	0.39
Playing chess	0.38
Reading books	0.37
Exercising	0.36
Education	0.32
Big parties	0.32
Smoking	0.31
Being the center of attention	0.28
Getting along well with other people	0.28
Wearing clothes that draw attention	0.24
Sweets	0.22
Public speaking	0.2
Castration as punishment for sex crimes	0.17
Loud music	0.11
Looking my best at all times	0.1
Doing crossword puzzles	0.02
Separate roles for men and women	0
Making racial discrimination illegal	0
Playing organized sports	0
Playing bingo	0
Easy access to birth control	0

Ranked from most heritable to least heritable. Data are from Olson, Vernon, Harris, and Jang (2001).

Attitude	Heritability
Being the leader of groups	0
Being assertive	0

Ranked from most heritable to least heritable. Data are from Olson, Vernon, Harris, and Jang (2001).

Our attitudes are made up of cognitive, affective, and behavioral components. Consider my own attitude toward chocolate ice cream, which is very positive and always has been, as far as I can remember.

In terms of affect:

I LOVE it!

In terms of behavior:

I frequently eat chocolate ice cream.

In terms of cognitions:

Chocolate ice cream has a smooth texture and a rich, strong taste.

My attitude toward chocolate ice cream is composed of affect, behavior, and cognition.

Although most attitudes are determined by cognition, affect, and behavior, there is nevertheless variability in this regard across people and across attitudes. Some attitudes are more likely to be based on beliefs, some more likely to be based on feelings, and some more likely to be based on behaviors. I would say that my attitude toward chocolate ice cream is in large part determined by affect—although I can describe its taste, mostly I just like it. My attitudes toward my Toyota Corolla and my home air conditioner, on the other hand, are more cognitive. I don't really like them so much as I admire their positive features (the Toyota gets good gas mileage and the air conditioner keeps me cool on hot summer days). Still other of my attitudes are based more on behavior—I feel like I've learned to like my neighbors because I've done favors for them over the years (which they have returned) and these helpful

behaviors on my part have, at least in part, led me to develop a positive attitude toward them.

Different people may hold attitudes toward the same attitude object for different reasons. Some people voted for Barack Obama in the 2008 elections because they like his policies ("he's working for the middle class"; "he wants to increase automobile fuel efficiency"), whereas others voted for (or against) him because they just liked (or disliked) him. Although you might think that cognition would be more important in this regard, political scientists have shown that many voting decisions are made primarily on the basis of affect. Indeed, it is fair to say that the affective component of attitudes is generally the strongest and most important (**Abelson, Kinder, Peters, & Fiske, 1981; Stangor, Sullivan, & Ford, 1991**).

Human beings hold attitudes because they are useful. Particularly, our attitudes enable us to determine, often very quickly and effortlessly, which behaviors to engage in, which people to approach or avoid, and even which products to buy (**Duckworth, Bargh, Garcia, & Chaiken, 2002; Maio & Olson, 2000**). You can imagine that making quick decisions about what to avoid

snake = bad ♦ run away
or to approach

blueberries = good ♦ eat

has had substantial value in our evolutionary experience.

Because attitudes are evaluations, they can be assessed using any of the normal measuring techniques used by social psychologists (**Banaji & Heiphetz, 2010**). Attitudes are frequently assessed using self-report measures, but they can also be assessed more indirectly using measures of arousal and facial expressions (**Mendes, 2008**) as well as implicit measures of cognition, such as the *Implicit Association Test (IAT)*.

Attitudes can also be seen in the brain by using neuroimaging techniques. This research has found that our attitudes, like most of our social knowledge, are stored primarily in the prefrontal cortex but that the amygdala is important in emotional attitudes, particularly those associated with fear (Cunningham, Raye, & Johnson, 2004; Cunningham & Zelazo, 2007; van den Bos, McClure, Harris, Fiske, & Cohen, 2007). Attitudes can be activated extremely quickly—often within one fifth of a second after we see an attitude object (Handy, Smilek, Geiger, Liu, & Schooler, 2010).

Some Attitudes Are Stronger Than Others

Some attitudes are more important than others, because they are more useful to us and thus have more impact on our daily lives. *The importance of an attitude, as assessed by how quickly it comes to mind*, is known as **attitude strength** (Fazio, 1990; Fazio, 1995; Krosnick & Petty, 1995). Some of our attitudes are strong attitudes, in the sense that we find them important, hold them with confidence, do not change them very much, and use them frequently to guide our actions. These strong attitudes may guide our actions completely out of our awareness (Ferguson, Bargh, & Nayak, 2005).

Other attitudes are weaker and have little influence on our actions. For instance, John Bargh and his colleagues (Bargh,

Chaiken, Raymond, & Hymes, 1996) found that people could express attitudes toward nonsense words such as *juvalamu* (which people liked) and *chakaka* (which they did not like). The researchers also found that these attitudes were very weak. On the other hand, the heavy voter turnout for Barack Obama in the 2008 elections was probably because many of his supporters had strong positive attitudes about him.

Strong attitudes are attitudes that are more cognitively accessible—they come to mind quickly, regularly, and easily. We can easily measure attitude strength by assessing how quickly our attitudes are activated when we are exposed to the attitude object. If we can state our attitude quickly, without much thought, then it is a strong one. If we are unsure about our attitude and need to think about it for a while before stating our opinion, the attitude is weak.

Attitudes become stronger when we have direct positive or negative experiences with the attitude object, and particularly if those experiences have been in strong positive or negative contexts. Russell Fazio and his colleagues (**Fazio, Powell, & Herr, 1983**) had people either work on some puzzles or watch other people work on the same puzzles. Although the people who watched ended up either liking or disliking the puzzles as much as the people who actually worked on them, Fazio found that attitudes, as assessed by reaction time measures, were stronger (in the sense of being expressed quickly) for the people who had directly experienced the puzzles.

Because attitude strength is determined by cognitive accessibility, it is possible to make attitudes stronger by increasing the accessibility of the attitude. This can be done directly by having people think about, express, or discuss their attitudes with others. After people think about their attitudes, talk about them, or just say them out loud, the attitudes they have expressed become stronger (**Downing, Judd, & Brauer, 1992; Tesser, Martin, & Mendolia, 1995**). Because attitudes are

linked to the self-concept, they also become stronger when they are activated along with the self-concept. When we are looking into a mirror or sitting in front of a TV camera, our attitudes are activated and we are then more likely to act on them (**Beaman, Klentz, Diener, & Svanum, 1979**).

Attitudes are also stronger when the ABCs of affect, behavior, and cognition all line up. As an example, many people's attitude toward their own nation is universally positive. They have strong positive feelings about their country, many positive thoughts about it, and tend to engage in behaviors that support it. Other attitudes are less strong because the affective, cognitive, and behavioral components are each somewhat different (**Thompson, Zanna, & Griffin, 1995**). My affect toward chocolate ice cream is positive—I like it a lot. On the other hand, my cognitions are more negative—I know that eating too much ice cream can make me fat and that it is bad for my coronary arteries. And even though I love chocolate ice cream, I don't eat some every time I get a chance. These inconsistencies among the components of my attitude make it less strong than it would be if all the components lined up together.

When Do Our Attitudes Guide Our Behavior?

Social psychologists (as well as advertisers, marketers, and politicians) are particularly interested in the behavioral aspect of attitudes. Because it is normal that the ABCs of our attitudes are at least somewhat consistent, our behavior tends to follow from our affect and cognition. If I determine that you have more positive cognitions about and more positive affect toward Cheerios than Frosted Flakes, then I will naturally predict (and probably be correct when I do so) that you'll be more likely to buy Cheerios than Frosted Flakes when you go to the market. Furthermore, if I can do something to make your thoughts or feelings toward Frosted Flakes more positive, then your likelihood of buying that cereal instead of the other will also increase.

The principle of **attitude consistency** (that *for any given attitude object, the ABCs of affect, behavior, and cognition are normally in line with each other*) thus predicts that our attitudes (for instance, as measured via a self-report measure) are likely to *guide behavior*. Supporting this idea, meta-analyses have found that there is a significant and substantial positive correlation among the different components of attitudes, and that attitudes expressed on self-report measures do predict behavior (**Glasman & Albarracín, 2006**).

Although there is generally consistency between attitudes and behavior, the relationship is stronger in certain situations, for certain people, and for certain attitudes (**Wicker, 1969**). The ***theory of planned behavior***, developed by Martin Fishbein

and Izek Ajzen (**Ajzen, 1991; Fishbein & Ajzen, 1975**), outlined many of the important variables that affected the attitude-behavior relationship, and some of these factors are summarized in the list that follows this paragraph. It may not surprise you to hear that attitudes that are strong, in the sense that they are expressed quickly and confidently, predict our behavior better than do weak attitudes (**Fazio, Powell, & Williams, 1989; Glasman & Albarracín, 2006**). For example, Farc and Sagarin (**2009**) found that people who could more quickly complete questionnaires about their attitudes toward the politicians George Bush and John Kerry were also more likely to vote for the candidate that they had more positive attitudes toward in the 2004 presidential elections. The relationship between the responses on the questionnaires and voting behavior was weaker for those who completed the items more slowly.

- When attitudes are strong, rather than weak
- When we have a strong intention to perform the behavior
- When the attitude and the behavior both occur in similar social situations
- When the same components of the attitude (either affect or cognition) are accessible when the attitude is assessed and when the behavior is performed
- When the attitudes are measured at a specific, rather than a general, level
- For low self-monitors (rather than for high self-monitors)

Attitudes only predict behaviors well under certain conditions and for some people. The preceding list summarizes the factors that create a strong attitude-behavior relationship.

People who have strong attitudes toward an attitude object are also likely to have strong *intentions* to act on their attitudes, and the intention to engage in an activity is a strong predictor of behavior (**Fishbein & Ajzen, 1975**). Imagine for a moment

that your friend Sharina is trying to decide whether to recycle her used laptop batteries or just throw them away. We know that her attitude toward recycling is positive—she thinks she should do it—but we also know that recycling takes work. It's much easier to just throw the batteries away. Only if Sharina has a strong attitude toward recycling will she then have the necessary strong intentions to engage in the behavior that will make her recycle her batteries even when it is difficult to do.

The match between the social situations in which the attitudes are expressed and the behaviors are engaged in also matters, such that there is a greater attitude-behavior correlation when the social situations match. Imagine for a minute the case of Magritte, a 16-year-old high school student. Magritte tells her parents that she hates the idea of smoking cigarettes. Magritte's negative attitude toward smoking seems to be a strong one because she's thought a lot about it—she believes that cigarettes are dirty, expensive, and unhealthy. But how sure are you that Magritte's attitude will predict her behavior? Would you be willing to bet that she'd never try smoking when she's out with her friends?

You can see that the problem here is that Magritte's attitude is being expressed in one social situation (when she is with her parents) whereas the behavior (trying a cigarette) is going to occur in a very different social situation (when she is out with her friends). The relevant social norms are of course much different in the two situations. Magritte's friends might be able to convince her to try smoking, despite her initial negative attitude, when they entice her with peer pressure. Behaviors are more likely to be consistent with attitudes when the social situation in which the behavior occurs is similar to the situation in which the attitude is expressed (**Ajzen, 1991; LaPiere, 1936**).

Research Focus

Attitude-Behavior Consistency

Another variable that has an important influence on attitude-behavior consistency is the current cognitive accessibility of the underlying affective and cognitive components of the attitude. For example, if we assess the attitude in a situation in which people are thinking primarily about the attitude object in cognitive terms, and yet the behavior is performed in a situation in which the affective components of the attitude are more accessible, then the attitude-behavior relationship will be weak. Wilson and Schooler (1991) showed a similar type of effect by first choosing attitudes that they expected would be primarily determined by affect—attitudes toward five different types of strawberry jam. Then they asked a sample of college students to taste each of the jams. While they were tasting, one-half of the participants were instructed to think about the cognitive aspects of their attitudes to these jams—that is, to focus on the reasons they held their attitudes, whereas the other half of the participants were not given these instructions. Then all

the students completed measures of their attitudes toward each of the jams.

Wilson and his colleagues then assessed the extent to which the attitudes expressed by the students correlated with taste ratings of the five jams as indicated by experts at *Consumer Reports*. They found that the attitudes expressed by the students correlated significantly higher with the expert ratings for the participants who had *not* listed their cognitions first. Wilson and his colleagues argued that this occurred because our liking of jams is primarily affectively determined—we either like them or we don't. And the students who simply rated the jams used their feelings to make their judgments. On the other hand, the students who were asked to list their thoughts about the jams had some extra information to use in making their judgments, but it was information that was not actually useful. Therefore, when these students used their thoughts about the jam to make the judgments, their judgments were less valid.

MacDonald, Zanna, and Fong (1996) showed male college students a video of two other college students, Mike and Rebecca, who were out on a date. However, according to random assignment to conditions, half of the men were shown the video while sober and the other half viewed the video after they had had several alcoholic drinks. In the video, Mike and Rebecca go to the campus bar and drink and dance. They then go to Rebecca's room, where they end up kissing passionately. Mike says that he doesn't have any condoms, but Rebecca says that she is on the pill.

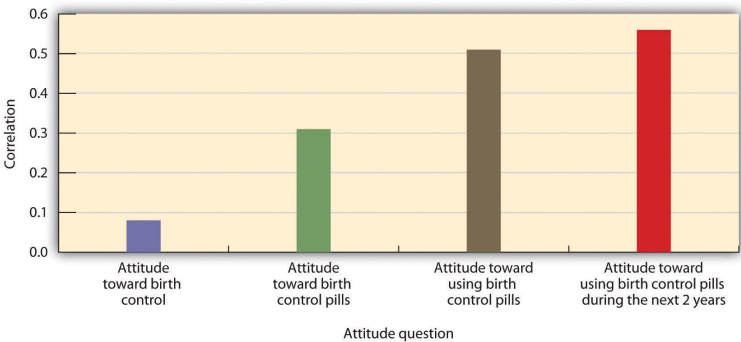
At this point the film clip ends, and the male

participants are asked about their likely behaviors if they had been Mike. Although all men indicated that having unprotected sex in this situation was foolish and irresponsible, the men who had been drinking alcohol were more likely to indicate that they would engage in sexual intercourse with Rebecca even without a condom. One interpretation of this study is that sexual behavior is determined by both cognitive factors ("I know that it is important to practice safe sex and so I should use a condom") and affective factors ("sex is enjoyable, I don't want to wait"). When the students were intoxicated at the time the behavior was to be performed, it seems likely the affective component of the attitude was a more important determinant of behavior than was the cognitive component.

One other type of "match" that has an important influence on the attitude-behavior relationship concerns how we measure the attitude and behavior. Attitudes predict behavior better when the attitude is measured at a level that is similar to the behavior to be predicted. Normally, the behavior is specific, so it is better to measure the attitude at a specific level too. For instance, if we measure cognitions at a very general level ("do you think it is important to use condoms?"; "are you a religious person?") we will not be as successful at predicting actual behaviors as we will be if we ask the question more specifically, at the level of behavior we are interested in predicting ("do you think you will use a condom the next time you have sex?"; "how frequently do you expect to attend church in the next month?"). In general, more specific questions are better predictors of specific behaviors, and thus if we wish to accurately predict behaviors, we should remember to attempt to measure *specific* attitudes. One example of this principle is

shown in Figure 5.1 “Predicting Behavior From Specific and Nonspecific Attitude Measures”. Davidson and Jaccard (1979) found that they were much better able to predict whether women actually used birth control when they assessed the attitude at a more specific level.

Figure 5.1 Predicting Behavior From Specific and Nonspecific Attitude Measures



Attitudes that are measured using more specific questions are more highly correlated with behavior than are attitudes measured using less specific questions. Data are from Davidson and Jaccard (1979).

Attitudes also predict behavior better for some people than for others. **Self-monitoring** refers to individual differences in the tendency to attend to social cues and to adjust one's behavior to one's social environment. To return to our example of Magritte, you might wonder whether she is the type of person who is likely to be persuaded by peer pressure because she is particularly concerned with being liked by others. If she is, then she's probably more likely to want to fit in with whatever her friends are doing, and she might try a cigarette if her friends offer her one. On the other hand, if Magritte is not particularly concerned about following the social norms of her friends, then she'll more likely be able to resist the persuasion. **High self-monitors** are those who tend to attempt to blend into the social situation in order to be liked; **low self-monitors** are those who are less likely to do so. You can see that, because they allow the social situation to influence their behaviors, the relationship between attitudes and behavior will be weaker for high self-monitors than it is for low self-monitors (Kraus, 1995).

Key Takeaways

- The term *attitude* refers to our relatively enduring evaluation of an attitude object.
- Our attitudes are inherited and also learned through direct and indirect experiences with the attitude objects.
- Some attitudes are more likely to be based on beliefs, some more likely to be based on feelings, and some more likely to be based on behaviors.
- Strong attitudes are important in the sense that we hold them with confidence, we do not change them very much, and we use them frequently to

guide our actions.

- Although there is a general consistency between attitudes and behavior, the relationship is stronger in some situations than in others, for some measurements than for others, and for some people than for others.

Changing Attitudes Through Persuasion

Learning Objectives

- Outline how persuasion is determined by the choice of effective communicators and effective messages.
- Review the conditions under which attitudes are best changed using spontaneous versus thoughtful strategies.
- Summarize the variables that make us more or less resistant to persuasive appeals.

Every day we are bombarded by advertisements of every sort. The goal of these ads is to sell us cars, computers, video games, clothes, and even political candidates. The ads appear on billboards, website popup ads, TV infomercials, and...well, you name it! It's been estimated that the average American child views over 40,000 TV commercials every year and that over \$400 billion is spent annually on advertising worldwide (Strasburger, 2001).

There is substantial evidence that advertising is effective in

changing attitudes. After the R. J. Reynolds Company started airing its Joe Camel ads for cigarettes on TV in the 1980s, Camel cigarettes' share of sales among children increased dramatically. But persuasion can also have more positive outcomes. Persuasion is used to encourage people to donate to charitable causes, to volunteer to give blood, and to engage in healthy behaviors. The dramatic decrease in cigarette smoking (from about half of the U.S. population who smoked in 1970 to only about a quarter who smoke today) is due in large part to effective advertising campaigns.

Section 3.2 “Emotions, Stress, and Well-Being” considers how we can change people’s attitudes. If you are interested in learning how to persuade others, you may well get some ideas in this regard. If you think that advertisers and marketers have too much influence, then this section will help you understand how to resist such attempts at persuasion. Following the approach used by some of the earliest social psychologists and that still forms the basis of thinking about the power of communication, we will consider which *communicators* can deliver the most effective *messages* to which types of *message recipients* (Hovland, Lumsdaine, & Sheffield (1949).

Choosing Effective Communicators

In order to be effective persuaders, we must first get people’s

attention, then send an effective message to them, and then ensure that they process the message in the way we would like them to. Furthermore, to accomplish these goals, persuaders must take into consideration the cognitive, affective, and behavioral aspects of their methods. Persuaders also must understand how the communication they are presenting relates to the message recipient—his or her motivations, desires, and goals.

Research has demonstrated that the same message will be more effective if it is delivered by a more persuasive communicator. In general we can say that communicators are more effective when they help their recipients feel good about themselves—that is, by appealing to self-concern. For instance, attractive communicators are frequently more effective persuaders than are unattractive communicators. Attractive communicators create a positive association with the product they are trying to sell and put us in a good mood, which makes us more likely to accept their messages. And as the many marketers who include free gifts, such as mailing labels or small toys, in their requests for charitable donations well know, we are more likely to respond to communicators who offer us something personally beneficial.

We're also more persuaded by people who are similar to us in terms of opinions and values than by those whom we perceive as being different. This is of course why advertisements targeted at teenagers frequently use teenagers to present the message, and why advertisements targeted at the elderly use older communicators.

When communicators are perceived as attractive and similar to us, we tend to like them. And we also tend to trust the people that we like. The success of Tupperware parties, in which friends get together to buy products from other friends, may be due more to the fact that people like the “salesperson” than to the nature of the product. People such as the newscaster Walter Cronkite and the film stars Tom Hanks and Reese

Witherspoon have been used as communicators for products in part because we see them as trustworthy and thus likely to present an unbiased message. Trustworthy communicators are effective because they allow us to feel good about ourselves when we accept their message, often without critically evaluating its content (**Priester & Petty, 2003**).



People such as the newscaster Walter Cronkite and the film stars Tom Hanks and Reese Witherspoon have been used as communicators for products in part because we see them as trustworthy and thus likely to present an unbiased message. Wikimedia Commons – public domain; Wikimedia Commons – public domain; Wikimedia Commons – public domain.

Expert communicators may sometimes be perceived as trustworthy because they know a lot about the product they

are selling. When a doctor recommends that we take a particular drug, we are likely to be influenced because we know that he or she has expertise about the effectiveness of drugs. It is no surprise that advertisers use race car drivers to sell cars and basketball players to sell athletic shoes.

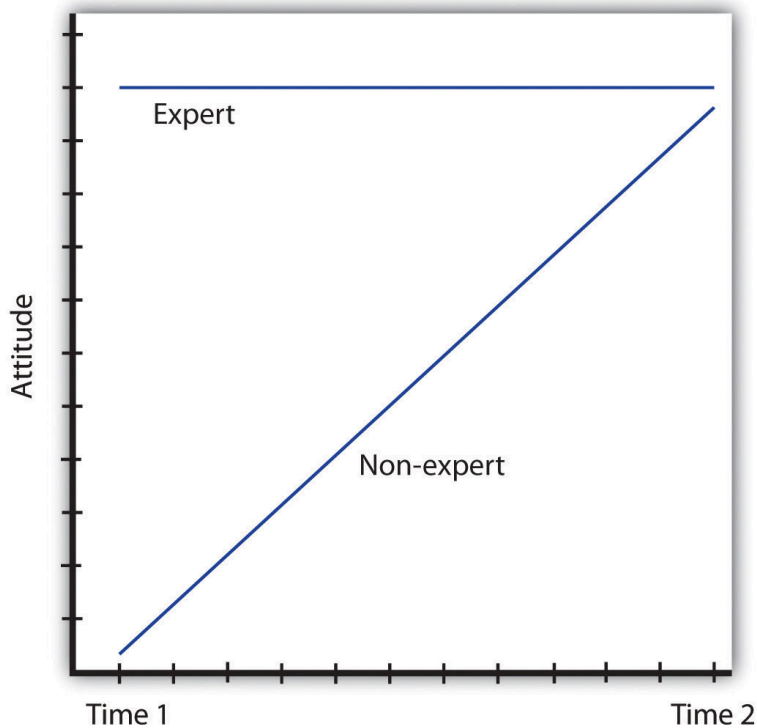
Although expertise comes in part from having knowledge, it can also be communicated by how one presents a message. Communicators who speak confidently, quickly, and in a straightforward way are seen as more expert than those who speak in a more hesitating and slower manner. Taking regular speech and speeding it up by deleting very small segments of it, so that it sounds the same but actually goes faster, makes the same communication more persuasive (**MacLachlan & Siegel, 1980; Moore, Hausknecht, & Thamodaran, 1986**). This is probably in part because faster speech makes the communicator seem more like an expert but also because faster speech reduces the listener's ability to come up with counterarguments as he or she listens to the message (**Megehee, Dobie, & Grant, 2003**). Effective speakers frequently use this technique, and some of the best persuaders are those who speak quickly.

Although expert communicators are expected to know a lot about the product they are endorsing, they may not be seen as trustworthy if their statements seem to be influenced by external causes. People who are seen to be arguing in their own self-interest (for instance, an expert witness who is paid by the lawyers in a case or a celebrity who is paid for her endorsement of a product) may be ineffective because we may discount their communications (**Eagly, Wood, & Chaiken, 1978; Wood & Eagly, 1981**). On the other hand, when a person presents a message that goes *against* external causes, for instance by arguing in favor of an opinion to a person who is known to disagree with it, we see the internal states (that the individual really believes in the message he or she is expressing) as even more powerful.

Communicators also may be seen as biased if they present only one side of an issue while completely ignoring the potential problems or counterarguments to the message. In these cases people who are informed about both sides of the topic may see the communicator as attempting to unfairly influence them.

Although we are generally very aware of the potential that communicators may deliver messages that are inaccurate or designed to influence us, and we are able to discount messages that come from sources that we do not view as trustworthy, there is one interesting situation in which we may be fooled by communicators. This occurs when a message is presented by someone that we perceive as untrustworthy. When we first hear that person's communication we appropriately discount it and it therefore has little influence on our opinions. However, over time there is a tendency to remember the *content* of a communication to a greater extent than we remember the *source* of the communication. As a result, we may forget over time to discount the remembered message. This *attitude change that occurs over time* is known as **the sleeper effect** (Kumkale & Albarracín, 2004).

Figure 5.2 The Sleeper Effect



The sleeper effect occurs when we initially discount the message given by an untrustworthy or nonexpert communicator but, over time, we remember the content of the message and forget its source. The result is attitude change in the direction of the initially discounted message.

Perhaps you've experienced the sleeper effect. Once, I told my friends a story that I had read about one of my favorite movie stars. Only later did I remember that I had read the story while I was waiting in the supermarket checkout line, and that I had read it in the *National Enquirer*! I knew that the story was probably false because the newspaper is considered unreliable, but I had initially forgotten to discount that fact because I did

not remember the source of the information. The sleeper effect is diagrammed in Figure 5.2 “The Sleeper Effect”.

Creating Effective Communications

Once we have chosen a communicator, the next step is to determine what type of message we should have him or her deliver. Neither social psychologists nor advertisers are so naïve as to think that simply presenting a strong message is sufficient. No matter how good the message is, it will not be effective unless people pay attention to it, understand it, accept it, and incorporate it into their self-concept. This is why we attempt to choose good communicators to present our ads in the first place, and why we tailor our communications to get people to process them the way we want them to.

Figure 5.3

Spontaneous attitude change:



Thoughtful attitude change:



Spontaneous attitude change occurs as a direct or affective response to the message, whereas thoughtful attitude change is based on our cognitive elaboration of the message.

The messages that we deliver may be processed either *spontaneously* (other terms for this include *peripherally* or *heuristically*—Chen & Chaiken, 1999; Petty & Wegener, 1999) or *thoughtfully* (other terms for this include *centrally* or *systematically*). **Spontaneous processing** is direct, quick, and often involves affective responses to the message. **Thoughtful processing**, on the other hand, is more controlled and involves a more careful cognitive elaboration of the meaning of the message (Figure 5.3). The route that we take when we process a communication is important in determining whether or not a particular message changes attitudes.

Spontaneous Message Processing

Because we are bombarded with so many persuasive messages—and because we do not have the time, resources, or interest to process every message fully—we frequently process messages spontaneously. In these cases, if we are influenced by the communication at all, it is likely that it is the relatively unimportant characteristics of the advertisement, such as the likeability or attractiveness of the communicator or the music playing in the ad, that will influence us.

If we find the communicator cute, if the music in the ad puts us in a good mood, or if it appears that other people around us like the ad, then we may simply accept the message without thinking about it very much (**Giner-Sorolla & Chaiken, 1997**). In these cases, we engage in **spontaneous message processing**, in which we *accept a persuasion attempt because we focus on whatever is most obvious or enjoyable, without much attention to the message itself*. Shelley Chaiken (1980) found that students who were not highly involved in a topic, because it did not affect them personally, were more persuaded by a likeable communicator than by an unlikeable one, regardless of whether the communicator presented a good argument for the topic or a poor one. On the other hand, students who were more involved in the decision were more persuaded by the better than by the poorer message, regardless of whether the communicator was likeable or not—they were not fooled by the likeability of the communicator.

You might be able to think of some advertisements that are likely to be successful because they create spontaneous processing of the message by basing their persuasive attempts

around creating emotional responses in the listeners. In these cases the advertisers use associational learning to associate the positive features of the ad with the product. Television commercials are often humorous, and automobile ads frequently feature beautiful people having fun driving beautiful cars. The slogans “The joy of cola!” “Coke adds life!” and “Be a Pepper!” are good ads in part because they successfully create positive affect in the listener.

In some cases emotional ads may be effective because they lead us to watch or listen to the ad rather than simply change the channel or doing something else. The clever and funny TV ads that are shown during the Super Bowl broadcast every year are likely to be effective because we watch them, remember them, and talk about them with others. In this case the positive affect makes the ads more salient, causing them to grab our attention. But emotional ads also take advantage of the role of affect in information processing. We tend to like things more when we are in good moods, and—because positive affect indicates that things are OK—we process information less carefully when we are in good moods. Thus the spontaneous approach to persuasion is particularly effective when people are happy (**Sinclair, Mark, & Clore, 1994**), and advertisers try to take advantage of this fact.

Another type of ad that is based on emotional responses is the one that uses fear appeals, such as ads that show pictures of deadly automobile accidents to encourage seatbelt use or images of lung cancer surgery to decrease smoking. By and large, fearful messages are persuasive (**Das, de Wit, & Stroebe, 2003; Perloff, 2003; Witte & Allen, 2000**). Again, this is due in part to the fact that the emotional aspects of the ads make them salient and lead us to attend to and remember them. And fearful ads may also be framed in a way that leads us to focus on the salient negative outcomes that have occurred for one particular individual. When we see an image of a person who is jailed for drug use, we may be able to empathize with

that person and imagine how we would feel if it happened to us. Thus this ad may be more effective than more “statistical” ads stating the base rates of the number of people who are jailed for drug use every year.

Fearful ads also focus on self-concern, and advertisements that are framed in a way that suggests that a behavior will harm the self are more effective than the same messages that are framed more positively. Banks, Salovey, Greener, and Rothman (1995) found that a message that emphasized the negative aspects of not getting a breast cancer screening mammogram (“not getting a mammogram can cost you your life”) was more effective than a similar message that emphasized the positive aspects (“getting a mammogram can save your life”) in getting women to have a mammogram over the next year. These findings are consistent with the general idea that the brain responds more strongly to negative affect than it does to positive affect (Ito, Larsen, Smith, & Cacioppo, 1998).

Although laboratory studies generally find that fearful messages are effective in persuasion, they have some problems that may make them less useful in real-world advertising campaigns (Hastings, Stead, & Webb, 2004). Fearful messages may create a lot of anxiety and therefore turn people off to the message (Shehryar & Hunt, 2005). For instance, people who know that smoking cigarettes is dangerous but who cannot seem to quit may experience particular anxiety about their smoking behaviors. Fear messages are more effective when people feel that they know how to rectify the problem, have the ability to actually do so, and take responsibility for the change. Without some feelings of self-efficacy, people do not know how to respond to the fear (Aspinwall, Kemeny, Taylor, & Schneider, 1991). Thus if you want to scare people into changing their behavior, it may be helpful if you also give them some ideas about how to do so, so

that they feel like they have the ability to take action to make the changes (Passyn & Sujan, 2006).



Source: http://www.fda.gov/TobaccoProducts/Labeling/ucm259214.htm#High_Resolution_Image_Formats

Thoughtful Message Processing

When we process messages only spontaneously, our feelings are more likely to be important, but when we process messages thoughtfully, cognition prevails. When we care about the topic, find it relevant, and have plenty of time to spend thinking about the communication, we are likely to process the message more deliberately, carefully, and thoughtfully (Petty & Briñol, 2008). In this case we *elaborate* on the communication by considering the pros and cons of the message and questioning the validity of the communicator and the message. **Thoughtful message processing** occurs when we think about how the message relates to our own beliefs and goals and involves our careful consideration of whether the persuasion attempt is valid or invalid.

When an advertiser presents a message that he or she hopes will be processed thoughtfully, the goal is to create positive cognitions about the attitude object in the listener. The communicator mentions positive features and characteristics of the product and at the same time attempts to downplay the negative characteristics. When people are asked to list their thoughts about a product while they are listening to, or right after they hear, a message, those who list more positive thoughts also express more positive attitudes toward the product than do those who list more negative thoughts (Petty & Briñol, 2008). Because the thoughtful processing of the message bolsters the attitude, thoughtful processing helps us develop strong attitudes, which are therefore resistant to counterpersuasion (Petty, Cacioppo, & Goldman, 1981).

Which Route Do We Take: Thoughtful or Spontaneous?

Both thoughtful and spontaneous messages can be effective, but it is important to know which is likely to be better in which situation and for which people. When we can motivate people to process our message carefully and thoughtfully, then we are going to be able to present our strong and persuasive arguments with the expectation that our audience will attend to them. If we can get the listener to process these strong arguments thoughtfully, then the attitude change will likely be strong and long lasting. On the other hand, when we expect our listeners to process only spontaneously—for instance, if they don't care too much about our message or if they are busy doing other things—then we do not need to worry so much about the content of the message itself; even a weak (but interesting) message can be effective in this case. Successful advertisers tailor their messages to fit the expected characteristics of their audiences.

In addition to being motivated to process the message, we must also have the ability to do so. If the message is too complex to understand, we may rely on spontaneous cues, such as the perceived trustworthiness or expertise of the communicator (**Hafer, Reynolds, & Obertynski, 1996**), and ignore the content of the message. When experts are used to attempt to persuade people—for instance, in complex jury trials—the messages that these experts give may be very difficult to understand. In these cases the jury members may rely on the perceived expertise of the communicator rather

than his or her message, being persuaded in a relatively spontaneous way. In other cases we may not be able to process the information thoughtfully because we are distracted or tired—in these cases even weak messages can be effective, again because we process them spontaneously (**Petty, Wells & Brock, 1976**).

Petty, Cacioppo, and Goldman (**1981**) showed how different motivations may lead to either spontaneous or thoughtful processing. In their research, college students heard a message suggesting that the administration at their college was proposing to institute a new comprehensive exam that all students would need to pass in order to graduate and then rated the degree to which they were favorable toward the idea. The researchers manipulated three independent variables:

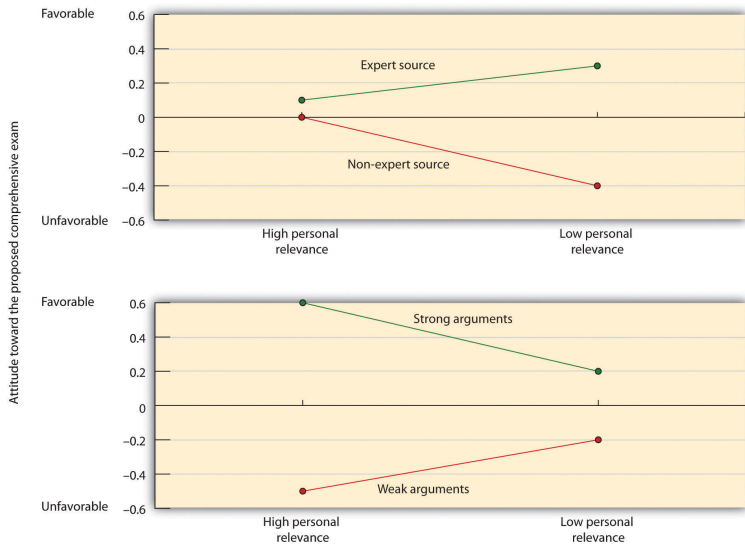
- **Message strength.** The message contained either *strong arguments* (persuasive data and statistics about the positive effects of the exams at other universities) or *weak arguments* (relying only on individual quotations and personal opinions).
- **Source expertise.** The message was supposedly prepared either by an *expert source* (the Carnegie Commission on Higher Education, which was chaired by a professor of education at Princeton University) or by a *nonexpert source* (a class at a local high school).
- **Personal relevance.** The students were told either that the new exam would begin before they graduated (*high personal relevance*) or that it would not begin until after they had already graduated (*low personal relevance*).

As you can see in Figure 5.4, Petty and his colleagues found two interaction effects. The top panel of the figure shows that the students in the high personal relevance condition (left side) were not particularly influenced by the expertise of the source, whereas the students in the low personal relevance condition

(right side) were. On the other hand, as you can see in the bottom panel, the students who were in the high personal relevance condition (left side) were strongly influenced by the quality of the argument, but the low personal involvement students (right side) were not.

These findings fit with the idea that when the issue was important, the students engaged in thoughtful processing of the message itself. When the message was largely irrelevant, they simply used the expertise of the source without bothering to think about the message.

Figure 5.4



Petty, Cacioppo, and Goldman (1981) found that students for whom an argument was not personally relevant based their judgments on the expertise of the source (spontaneous processing), whereas students for whom the decision was more relevant were more influenced by the quality of the message (thoughtful processing).

Because both thoughtful and spontaneous approaches can be successful, advertising campaigns, such as those used by the Obama presidential campaign, carefully make use of both spontaneous and thoughtful messages. In some cases, the messages showed Obama smiling, shaking hands with people around him, and kissing babies; in other ads Obama was shown presenting his plans for energy efficiency and climate change in more detail.

Preventing Persuasion

To this point we have focused on techniques designed to change attitudes. But it is also useful to develop techniques that *prevent* attitude change. If you are hoping that Magritte will never puff that first cigarette, then you might be interested in knowing what her parents might be able to do to prevent it from happening.

One approach to improving an individual's ability to resist persuasion is to help the person create a strong attitude. Strong attitudes are more difficult to change than are weak attitudes, and we are more likely to act on our strong attitudes. This suggests that Magritte's parents might want help Magritte consider all the reasons that she should not smoke and develop strong negative affect about smoking. As Magritte's negative thoughts and feelings about smoking become more well-defined and more integrated into the self-concept, they should have a bigger influence on her behavior.

One method of increasing attitude strength involves **forewarning**: *giving people a chance to develop a resistance to persuasion by reminding them that they might someday receive a persuasive message, and allowing them to practice how they will respond to influence attempts* (**Sagarin & Wood, 2007**). Magritte's parents might want to try the forewarning approach. After the forewarning, when Magritte hears the smoking message from her peers, she may be less influenced by it because she was aware ahead of time that the persuasion would likely occur and had already considered how to resist it.

Forewarning seems to be particularly effective when the message that is expected to follow attacks an attitude that we care a lot about. In these cases the forewarning prepares us

for action—we bring up our defenses to maintain our existing beliefs. When we don't care much about the topic, on the other hand, we may simply change our belief before the appeal actually comes (Wood & Quinn, 2003).

Forewarning can be effective in helping people respond to persuasive messages that they will receive later.

A similar approach is to help build up the cognitive component of the attitude by presenting a weak attack on the existing attitude with the goal of helping the person create counterarguments about a persuasion attempt that is expected to come in the future. Just as an inoculation against the flu gives us a small dose of the influenza virus that helps prevent a bigger attack later, giving Magritte a weak argument to persuade her to smoke cigarettes can help her develop ways to resist the real attempts when they come in the future. This procedure—known as **inoculation**—involves building up defenses against persuasion by mildly attacking the attitude position (Compton & Pfau, 2005; McGuire, 1961). We would begin by telling Magritte the reasons that her friends might think that she *should* smoke (for instance, because everyone is doing it and it makes people look “cool”), therefore allowing her to create some new defenses against persuasion. Thinking about the potential arguments that she might receive and preparing the corresponding counterarguments will make the attitude stronger and more resistant to subsequent change attempts.

One difficulty with forewarning and inoculation attempts is that they may boomerang. If we feel that another person—for instance, a person who holds power over us—is attempting to take away our freedom to make our own decisions, we may respond with strong emotion, completely ignore the persuasion attempt, and perhaps even engage in the opposite behavior. Perhaps you can remember a time when you felt like your parents or someone else who had some power over you put too much pressure on you, and you rebelled against them.

The strong emotional response that we experience when we feel that our freedom of choice is being taken away when we expect that we should have choice is known as **psychological reactance** (Brehm, 1966; Miron & Brehm, 2006). If Magritte's parents are too directive in their admonitions about not smoking, she may feel that they do not trust her to make her own decisions and are attempting to make them for her. In this case she may experience reactance and become *more* likely to start smoking. Erceg-Hurn and Steed (2011) found that the graphic warning images that are placed on cigarette packs could create reactance in people who viewed them, potentially reducing the warnings' effectiveness in convincing people to stop smoking.

Given the extent to which our judgments and behaviors are frequently determined by processes that occur outside of our conscious awareness, you might wonder whether it is possible to persuade people to change their attitudes or to get people to buy products or engage in other behaviors using subliminal advertising. **Subliminal advertising** occurs when a message, such as an advertisement or another image of a brand, is presented to the consumer without the person being aware that a message has been presented—for instance, by flashing messages quickly in a TV show, an advertisement, or a movie (Theus, 1994).

Social Psychology in the Public Interest

Does Subliminal Advertising Work?

If it were effective, subliminal advertising would have some major advantages for advertisers because it would allow them to promote their product without directly interrupting the consumer's activity and without the consumer knowing that he or she is being persuaded (Trappey, 1996). People cannot counterargue with, or attempt to avoid being influenced by, messages that they do not know they have received and this may make subliminal advertising particularly effective. Due to fears that people may be influenced to buy products out of their awareness, subliminal advertising has been legally banned in many countries, including Australia, Great Britain, and the United States.

Some research has suggested that subliminal advertising may be effective. Karremans, Stroebe, and

Claus (2006) had Dutch college students view a series of computer trials in which a string of letters such as *BBBBBBBBBB* or *BBBbBBBBBB* was presented on the screen and the students were asked to pay attention to whether or not the strings contained a small *b*. However, immediately before each of the letter strings, the researchers presented either the name of a drink that is popular in Holland ("Lipton Ice") or a control string containing the same letters as Lipton Ice ("Npeic Tol"). The priming words were presented so quickly (for only about 1/50th of a second) that the participants could not see them.

Then the students were asked to indicate their intention to drink Lipton Ice by answering questions such as "If you would sit on a terrace now, how likely is it that you would order Lipton Ice?" and also to indicate how thirsty they were at this moment. The researchers found that the students who had been exposed to the Lipton Ice primes were significantly more likely to say that they would drink Lipton Ice than were those who had been exposed to the control words, but that this was only true for the participants who said that they were currently thirsty.

On the other hand, other research has not supported the effectiveness of subliminal advertising. Charles Trappey (1996) conducted a meta-analysis in which he combined 23 research studies that had tested the influence of subliminal advertising on consumer choice. The results of his meta-analysis showed that subliminal advertising had a "negligible effect on consumer choice." Saegert (1987) concluded that "marketing should quit giving subliminal advertising

the benefit of the doubt" (p. 107), arguing that the influences of subliminal stimuli are usually so weak that they are normally overshadowed by the person's own decision making about the behavior.

Even if a subliminal or subtle advertisement is perceived, previous experience with the product or similar products—or even unrelated, more salient stimuli at the moment—may easily overshadow any effect the subliminal message would have had (Moore, 1988). That is, even if we do perceive the “hidden” message, our prior attitudes or our current situation will likely have a stronger influence on our choices, potentially nullifying any effect the subliminal message would have had.

Taken together, the evidence for the effectiveness of subliminal advertising is weak and its effects may be limited to only some people and only some conditions. You probably don't have to worry too much about being subliminally persuaded in your everyday life even if subliminal ads are allowed in your country. Of course, although subliminal advertising is not that effective, there are plenty of other indirect advertising techniques that are. Many ads for automobiles and alcoholic beverages have sexual connotations, which indirectly (even if not subliminally) associate these positive features with their products. And there are the ever more frequent “product placement” techniques, where images of brands (cars, sodas, electronics, and so forth) are placed on websites and in popular TV shows and movies.

Key Takeaways

- Advertising is effective in changing attitudes, and principles of social psychology can help us understand when and how advertising works.
- Social psychologists study which communicators can deliver the most effective messages to which types of message recipients.
- Communicators are more effective when they help their recipients feel good about themselves. Attractive, similar, trustworthy, and expert communicators are examples of effective communicators.
- Attitude change that occurs over time, particularly when we no longer discount the impact of a low-credibility communicator, is known as the sleeper effect.
- The messages that we deliver may be processed either spontaneously or thoughtfully. When we are processing messages only spontaneously, our feelings are more likely to be important, but when we process the message thoughtfully, cognition prevails.
- Both thoughtful and spontaneous messages can be effective, in different situations and for different people.
- One approach to improving an individual's ability to resist persuasion is to help the person create a strong attitude. Procedures such as forewarning and inoculation can help increase attitude strength and thus reduce subsequent

persuasion.

- Taken together, the evidence for the effectiveness of subliminal advertising is weak, and its effects may be limited to only some people and only some conditions.

Although we might use the term in a different way in our everyday life ("Hey, he's really got an *attitude!*"), social psychologists reserve the term attitude to refer to our *relatively enduring evaluation of something*, where the something is called the *attitude object*. The attitude object might be a person, a product, or a social group (Albarracín, Johnson, & Zanna, 2005; Wood, 2000). In this section we will consider the nature and strength of attitudes and the conditions under which attitudes best predict our behaviors.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Attitude

A psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor.

Attitude consistency

For any given attitude object, the ABCs of affect, behavior, and cognition are normally in line with each other

Attitude object

A person, a product, or a social group

Attitude strength

The importance of an attitude, as assessed by how quickly it comes to mind

Expert communicators

Perceived as trustworthy because they know a lot about the product they are selling

Forewarning

Giving people a chance to develop a resistance to persuasion by reminding them that they might someday receive a persuasive message, and allowing them to practice how they will respond to influence attempts

High self-monitors

Those who tend to attempt to blend into the social situation in order to be liked

Inoculation

Building up defenses against persuasion by mildly attacking the attitude position

Low self-monitors

Those who are less likely to attempt to blend into the social situation in order to be liked

Psychological reactance

A reaction to people, rules, requirements, or offerings that are perceived to limit freedoms.

Self-monitoring

Individual differences in the tendency to attend to social cues and to adjust one's behavior to one's social environment

Spontaneous message processing

When we accept a persuasion attempt because we focus on whatever is most obvious or enjoyable, without much attention to the message itself.

Subliminal advertising

Occurs when a message, such as an advertisement or another image of a brand, is presented to the consumer without the person being aware that a message has been presented

Theory of planned behavior

The relationship between attitudes and behavior is stronger in certain situations, for certain people and for certain attitudes

The sleeper effect

Attitude change that occurs over time

Thoughtful message processing

When we think about how the message relates to our own beliefs and goals and involves our careful consideration of whether the persuasion attempt is valid or invalid

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Previous: 5.1 Exploring Attitudes

Next: 5.3 Changing Attitudes by Changing Behavior

This course makes use of Open Educational Resources. Information on the original source of this chapter can be found below.

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66. The Psychology of Groups

Original chapter by Donelson R. Forsyth, adapted by the Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen’s Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

This module assumes that a thorough understanding of people requires a thorough understanding of groups. Each of us is an autonomous individual seeking our own objectives, yet we are also members of groups—groups that constrain us, guide us, and sustain us. Just as each of us influences the group and the people in the group, so, too, do groups change each one of us. Joining groups satisfies our need to belong, gain information and understanding through social comparison, define our sense of self and social identity, and achieve goals that might elude us if we worked alone. Groups are also practically significant, for much of the world’s work is done by groups rather than by individuals. Success sometimes eludes our groups, but when group members learn to work together as a cohesive team their success becomes more certain. People also turn to groups when important decisions must be made, and this choice is justified as long as groups avoid such problems as group polarization and groupthink.

Learning Objectives

- Review the evidence that suggests humans have a fundamental need to belong to groups.
- Compare the sociometer model of self-esteem to a more traditional view of self-esteem.
- Use theories of social facilitation to predict when a group will perform tasks slowly or quickly (e.g., students eating a meal as a group, workers on an assembly line, or a study group).
- Summarize the methods used by Latané, Williams, and Harkins to identify the relative impact of social loafing and coordination problems on group performance.
- Describe how groups change over time.
- Apply the theory of groupthink to a well-known decision-making group, such as the group of advisors responsible for planning the Bay of Pigs operation.
- List and discuss the factors that facilitate and impede group performance and decision making.
- Develop a list of recommendations that, if followed, would minimize the possibility of groupthink developing in a group.

The Psychology of Groups

Psychologists study groups because nearly all human activities—working, learning, worshiping, relaxing, playing, and even sleeping—occur in groups. The lone individual who is cut off from all groups is a rarity. Most of us live out our lives in groups, and these groups have a profound impact on our thoughts, feelings, and actions. Many psychologists focus their attention on single individuals, but social psychologists expand their analysis to include groups, organizations, communities, and even cultures.



How many groups are you a part of on a daily basis? Whether it's family, class, work, social, sports, church or other areas, we typically spend a good deal of our time and attention each day interacting with others in groups. [Image: CCO Public Domain, <https://goo.gl/m25gce>]

This module examines the psychology of groups and group membership. It begins with a basic question: What is the psychological significance of groups? People are, undeniably, more often in groups rather than alone. What accounts for this marked gregariousness and what does it say about our psychological makeup? The module then reviews some of the key findings from studies of groups. Researchers have asked many questions about people and groups: Do people work as hard as they can when they are in groups? Are groups more cautious than individuals? Do groups make wiser decisions than single individuals? In many cases the answers are not what common sense and folk wisdom might suggest.

The Psychological Significance of Groups

Many people loudly proclaim their autonomy and independence. Like Ralph Waldo Emerson, they avow, “I must be myself. I will not hide my tastes or aversions . . . I will seek my own” (1903/2004, p. 127). Even though people are capable of living separate and apart from others, they join with others because groups meet their psychological and social needs.

The Need to Belong



The need to belong is a strong psychological motivation. [Image: CC0 Public Domain, <https://goo.gl/m25gce>]

Across individuals, societies, and even eras, humans consistently seek inclusion over exclusion, membership over isolation, and acceptance over rejection. As Roy Baumeister and Mark Leary conclude, humans have a *need to belong*: “a pervasive drive to form and maintain at least a minimum quantity of lasting, positive, and impactful

interpersonal relationships” (1995, p. 497). And most of us satisfy this need by joining groups. When surveyed, 87.3% of Americans reported that they lived with other people, including family members, partners, and roommates (Davis & Smith, 2007). The majority, ranging from 50% to 80%, reported regularly doing things in groups, such as attending a sports event together, visiting one another for the evening, sharing a

meal together, or going out as a group to see a movie (**Putnam, 2000**).

People respond negatively when their need to belong is unfulfilled. For example, college students often feel homesick and lonely when they first start college, but not if they belong to a cohesive, socially satisfying group (**Buote et al., 2007**). People who are accepted members of a group tend to feel happier and more satisfied. But should they be rejected by a group, they feel unhappy, helpless, and depressed. Studies of **ostracism**—the deliberate exclusion from groups—indicate this experience is highly stressful and can lead to depression, confused thinking, and even aggression (**Williams, 2007**). When researchers used a functional magnetic resonance imaging scanner to track neural responses to exclusion, they found that people who were left out of a group activity displayed heightened cortical activity in two specific areas of the brain—the dorsal anterior cingulate cortex and the anterior insula. These areas of the brain are associated with the experience of physical pain sensations (**Eisenberger, Lieberman, & Williams, 2003**). It hurts, quite literally, to be left out of a group.

Affiliation in Groups

Groups not only satisfy the need to belong, they also provide members with information, assistance, and social support. Leon Festinger's theory of **social comparison** suggested that in many cases people join with others to evaluate the accuracy of their personal beliefs and attitudes. Stanley Schachter (**1959**) explored this process by putting individuals in ambiguous, stressful situations and asking them if they wished to wait alone or with others. He found that people *affiliate* in such situations—they seek the company of others.

Although any kind of companionship is appreciated, we

prefer those who provide us with reassurance and support as well as accurate information. In some cases, we also prefer to join with others who are even worse off than we are. Imagine, for example, how you would respond when the teacher hands back the test and yours is marked 85%. Do you want to affiliate with a friend who got a 95% or a friend who got a 78%? To maintain a sense of self-worth, people seek out and compare themselves to the less fortunate. This process is known as *downward social comparison*.

Identity and Membership

Groups are not only founts of information during times of ambiguity, they also help us answer the existentially significant question, “Who am I?” Common sense tells us that our sense of self is our private definition of who we are, a kind of archival record of our experiences, qualities, and capabilities. Yet, the self also includes all those qualities that spring from memberships in groups. People are defined not only by their traits, preferences, interests, likes, and dislikes, but also by their friendships, social roles, family connections, and group memberships. The self is not just a “me,” but also a “we.”

Even demographic qualities such as sex or age can influence us if we categorize ourselves based on these qualities. **Social identity theory**, for example, assumes that we don't just classify *other* people into such social categories as man, woman, Anglo, elderly, or college student, but we also categorize ourselves. Moreover, if we strongly identify with these categories, then we will ascribe the characteristics of the typical member of these groups to ourselves, and so stereotype ourselves. If, for example, we believe that college students are intellectual, then we will assume we, too, are intellectual if we identify with that group (**Hogg, 2001**).

Groups also provide a variety of means for maintaining and

enhancing a sense of self-worth, as our assessment of the quality of groups we belong to influences our **collective self-esteem** (Crocker & Luhtanen, 1990). If our self-esteem is shaken by a personal setback, we can focus on our group's success and prestige. In addition, by comparing our group to other groups, we frequently discover that we are members of the better group, and so can take pride in our superiority. By denigrating other groups, we elevate both our personal and our collective self-esteem (Crocker & Major, 1989).

Mark Leary's **sociometer model** goes so far as to suggest that "self-esteem is part of a sociometer that monitors peoples' relational value in other people's eyes" (2007, p. 328). He maintains self-esteem is not just an index of one's sense of personal value, but also an indicator of acceptance into groups. Like a gauge that indicates how much fuel is left in the tank, a dip in self-esteem indicates exclusion from our group is likely. Disquieting feelings of self-worth, then, prompt us to search for and correct characteristics and qualities that put us at risk of social exclusion. Self-esteem is not just high self-regard, but the self-approration that we feel when included in groups (Leary & Baumeister, 2000).

Evolutionary Advantages of Group Living

Groups may be humans' most useful invention, for they provide us with the means to reach goals that would elude us if we remained alone. Individuals in groups can secure advantages and avoid disadvantages that would plague the lone individuals. In his theory of social integration, Moreland concludes that groups tend to form whenever "people become dependent on one another for the satisfaction of their needs" (1987, p. 104). The advantages of group life may be so great that humans are biologically prepared to seek membership and avoid isolation. From an evolutionary psychology perspective,

because groups have increased humans' overall fitness for countless generations, individuals who carried genes that promoted solitude-seeking were less likely to survive and procreate compared to those with genes that prompted them to join groups (**Darwin, 1859/1963**). This process of natural selection culminated in the creation of a modern human who seeks out membership in groups instinctively, for most of us are descendants of “joiners” rather than “loners.”

Motivation and Performance

Groups usually exist for a reason. In groups, we solve problems, create products, create standards, communicate knowledge, have fun, perform arts, create institutions, and even ensure our safety from attacks by other groups. But do groups always outperform individuals?

Social Facilitation in Groups

Do people perform more effectively when alone or when part of a group? Norman Triplett (1898) examined this issue in one of the first empirical studies in psychology. While watching bicycle races, Triplett noticed that cyclists were faster when they competed against other racers than when they raced alone against the clock. To determine if the presence of others leads to the psychological stimulation that enhances performance, he arranged for 40 children to play a game that involved turning a small reel as quickly as possible (see Figure 1). When he measured how quickly they turned the reel, he confirmed that children performed slightly better when they played the game in pairs compared to when they played alone (see **Stroebe, 2012; Strube, 2005**).

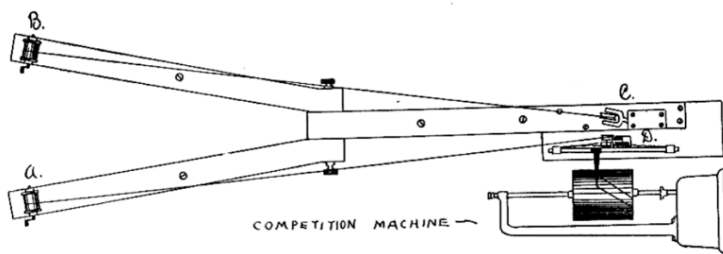


Figure 1: The “competition machine” Triplett used to study the impact of competition on performance. Triplett’s study was one of the first laboratory studies conducted in the field of social psychology. Triplett, N. (1898)

Triplett succeeded in sparking interest in a phenomenon now known as **social facilitation**: the enhancement of an individual’s performance when that person works in the presence of other people. However, it remained for Robert Zajonc (1965) to specify when social facilitation does and does not occur. After reviewing prior research, Zajonc noted that the facilitating effects of an audience usually only occur when the task requires the person to perform dominant responses, i.e., ones that are well-learned or based on instinctive behaviors. If the task requires nondominant responses, i.e., novel, complicated, or untried behaviors that the organism has never performed before or has performed only infrequently, then the presence of others inhibits performance. Hence, students write poorer quality essays on complex philosophical questions when they labor in a group rather than alone (Allport, 1924), but they make fewer mistakes in solving simple, low-level multiplication problems with an audience or a coactor than when they work in isolation (Dashiell, 1930).

Social facilitation, then, depends on the task: other people facilitate performance when the task is so simple that it requires only dominant responses, but others interfere when

the task requires nondominant responses. However, a number of psychological processes combine to influence when social facilitation, not social interference, occurs. Studies of the challenge-threat response and brain imaging, for example, confirm that we respond physiologically and neurologically to the presence of others (**Blascovich, Mendes, Hunter, & Salomon, 1999**). Other people also can trigger *evaluation apprehension*, particularly when we feel that our individual performance will be known to others, and those others might judge it negatively (**Bond, Atoum, & VanLeeuwen, 1996**). The presence of other people can also cause perturbations in our capacity to concentrate on and process information (**Harkins, 2006**). Distractions due to the presence of other people have been shown to improve performance on certain tasks, such as the *Stroop task*, but undermine performance on more cognitively demanding tasks (**Huguet, Galvaing, Monteil, & Dumas, 1999**).

Social Loafing

Groups usually outperform individuals. A single student, working alone on a paper, will get less done in an hour than will four students working on a group project. One person playing a tug-of-war game against a group will lose. A crew of movers can pack up and transport your household belongings faster than you can by yourself. As the saying goes, “Many hands make light the work” (**Littlepage, 1991; Steiner, 1972**).

Groups, though, tend to be underachievers. Studies of social facilitation confirmed the positive motivational benefits of working with other people on well-practiced tasks in which each member’s contribution to the collective enterprise can be identified and evaluated. But what happens when tasks require a truly collective effort? First, when people work together they must coordinate their individual activities and

contributions to reach the maximum level of efficiency—but they rarely do (**Diehl & Stroebe, 1987**). Three people in a tug-of-war competition, for example, invariably pull and pause at slightly different times, so their efforts are uncoordinated. The result is *coordination loss*: the three-person group is stronger than a single person, but not three times as strong. Second, people just don't exert as much effort when working on a collective endeavor, nor do they expend as much cognitive effort trying to solve problems, as they do when working alone. They display **social loafing**(**Latané, 1981**).

Bibb Latané, Kip Williams, and **Stephen Harkins (1979)** examined both coordination losses and social loafing by arranging for students to cheer or clap either alone or in groups of varying sizes. The students cheered alone or in 2- or 6-person groups, or they were lead to believe they were in 2- or 6-person groups (those in the “pseudo-groups” wore blindfolds and headsets that played masking sound). As Figure 2 indicates, groups generated more noise than solitary subjects, but the productivity dropped as the groups became larger in size. In dyads, each subject worked at only 66% of capacity, and in 6-person groups at 36%. Productivity also dropped when subjects merely believed they were in groups. If subjects thought that one other person was shouting with them, they shouted 82% as intensely, and if they thought five other people were shouting, they reached only 74% of their capacity. These loses in productivity were not due to coordination problems; this decline in production could be attributed only to a reduction in effort—to social loafing (**Latané et al., 1979, Experiment 2**).

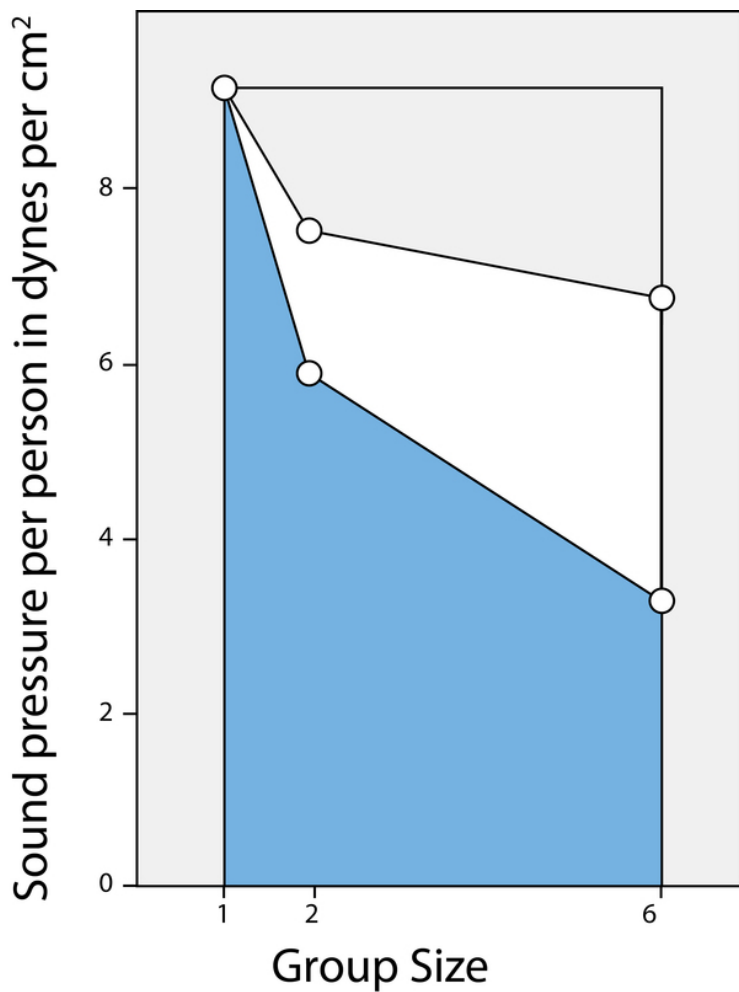


Figure 2: Sound pressure per person as a function of group or pseudo group size. Latane, B. (1981)

Teamwork



Social loafing can be a problem. One way to overcome it is by recognizing that each group member has an important part to play in the success of the group.

[Image: Marc Dalmulder, <https://goo.gl/Xa5aiE>, CC BY 2.0, <https://goo.gl/BRvSA7>]

Social loafing is no rare phenomenon. When sales personnel work in groups with shared goals, they tend to “take it easy” if another salesperson is nearby who can do their work (**George, 1992**). People who are trying to generate new, creative ideas in group brainstorming sessions usually put in less effort and are thus less productive than people who are generating new ideas individually (**Paulus & Brown, 2007**). Students assigned group projects often

complain of inequity in the quality and quantity of each member’s contributions: Some people just don’t work as much as they should to help the group reach its learning goals (**Neu, 2012**). People carrying out all sorts of physical and mental tasks expend less effort when working in groups, and the larger the group, the more they loaf (**Karau & Williams, 1993**).

Groups can, however, overcome this impediment to performance through **teamwork**. A group may include many talented individuals, but they must learn how to pool their individual abilities and energies to maximize the team’s performance. Team goals must be set, work patterns structured, and a sense of group identity developed. Individual members must learn how to coordinate their actions, and any strains and stresses in interpersonal relations need to be identified and resolved (**Salas, Rosen, Burke, & Goodwin, 2009**).

Researchers have identified two key ingredients to effective teamwork: a shared mental representation of the task and group unity. Teams improve their performance over time as they develop a shared understanding of the team and the tasks they are attempting. Some semblance of this **shared mental model** is present nearly from its inception, but as the team practices, differences among the members in terms of their understanding of their situation and their team diminish as a consensus becomes implicitly accepted (**Tindale, Stawiski, & Jacobs, 2008**).

Effective teams are also, in most cases, cohesive groups (**Dion, 2000**). **Group cohesion** is the integrity, solidarity, social integration, or unity of a group. In most cases, members of cohesive groups like each other and the group and they also are united in their pursuit of collective, group-level goals. Members tend to enjoy their groups more when they are cohesive, and cohesive groups usually outperform ones that lack cohesion.

This cohesion-performance relationship, however, is a complex one. Meta-analytic studies suggest that cohesion improves teamwork among members, but that performance quality influences cohesion more than cohesion influences performance (**Mullen & Copper, 1994; Mullen, Driskell, & Salas, 1998**; see Figure 3). Cohesive groups also can be spectacularly unproductive if the group's norms stress low productivity rather than high productivity (**Seashore, 1954**).

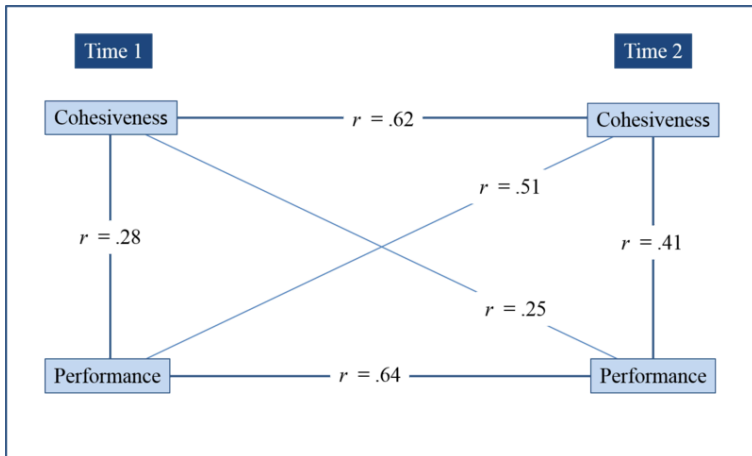


Figure 3: The relationship between group cohesion and performance over time. Groups that are cohesive do tend to perform well on tasks now (Time1) and in the future (Time 2). Notice, though, that the relationship between Performance at Time 1 and Cohesiveness at Time 2 is greater ($r=.51$) than the relationship between Cohesion at Time 1 and Performance at Time 2 ($r=.25$). These findings suggest that cohesion improves performance, but that a group that performs well is likely to also become more cohesive. Mullen, Driskell, & Salas (1998)

Group Development

In most cases groups do not become smooth-functioning teams overnight. As Bruce Tuckman's (1965) theory of group development suggests, groups usually pass through several stages of development as they change from a newly formed group into an effective team. As noted in Focus Topic 1, in the *forming* phase, the members become oriented toward one another. In the *storming* phase, the group members find themselves in conflict, and some solution is sought to improve the group environment. In the *norming*, phase standards for behavior and roles develop that regulate behavior. In the *performing*, phase the group has reached a point where it can work as a unit to achieve desired goals, and

the *adjourning* phase ends the sequence of development; the group disbands. Throughout these stages groups tend to oscillate between the task-oriented issues and the relationship issues, with members sometimes working hard but at other times strengthening their interpersonal bonds (Tuckman & Jensen, 1977).

Focus Topic 1: Group Development Stages and Characteristics

Stage 1 – “Forming”. Members expose information about themselves in polite but tentative interactions. They explore the purposes of the group and gather information about each other’s interests, skills, and personal tendencies.

Stage 2 – “Storming”. Disagreements about procedures and purposes surface, so criticism and conflict increase. Much of the conflict stems from challenges between members who are seeking to increase their status and control in the group.

Stage 3 – “Norming”. Once the group agrees on its goals, procedures, and leadership, norms, roles, and social relationships develop that increase the group’s stability and cohesiveness.

Stage 4 – “Performing”. The group focuses its energies and attention on its goals, displaying higher rates of task-orientation, decision-making, and problem-solving.

Stage 5 – “Adjourning”. The group prepares to disband by completing its tasks, reduces levels of dependency among members, and dealing with any unresolved issues.

Sources based on Tuckman (1965) and Tuckman & Jensen (1977)

We also experience change as we pass through a group, for we don’t become full-fledged members of a group in an

instant. Instead, we gradually become a part of the group and remain in the group until we leave it. Richard Moreland and John Levine's (1982) model of group socialization describes this process, beginning with initial entry into the group and ending when the member exits it. For example, when you are thinking of joining a new group—a social club, a professional society, a fraternity or sorority, or a sports team—you investigate what the group has to offer, but the group also investigates you. During this investigation stage you are still an outsider: interested in joining the group, but not yet committed to it in any way. But once the group accepts you and you accept the group, socialization begins: you learn the group's norms and take on different responsibilities depending on your role. On a sports team, for example, you may initially hope to be a star who starts every game or plays a particular position, but the team may need something else from you. In time, though, the group will accept you as a full-fledged member and both sides in the process—you and the group itself—increase their commitment to one another. When that commitment wanes, however, your membership may come to an end as well.

Making Decisions in Groups

Groups are particularly useful when it comes to making a decision, for groups can draw on more resources than can a lone individual. A single individual may know a great deal about a problem and possible solutions, but his or her information is far surpassed by the combined knowledge of a group. Groups not only generate more ideas and possible solutions by discussing the problem, but they can also more objectively evaluate the options that they generate during discussion. Before accepting a solution, a group may require that a certain number of people favor it, or that it meets some

other standard of acceptability. People generally feel that a group's decision will be superior to an individual's decision.

Groups, however, do not always make good decisions. Juries sometimes render verdicts that run counter to the evidence presented. Community groups take radical stances on issues before thinking through all the ramifications. Military strategists concoct plans that seem, in retrospect, ill-conceived and short-sighted. Why do groups sometimes make poor decisions?

Group Polarization

Let's say you are part of a group assigned to make a presentation. One of the group members suggests showing a short video that, although amusing, includes some provocative images. Even though initially you think the clip is inappropriate, you begin to change your mind as the group discusses the idea. The group decides, eventually, to throw caution to the wind and show the clip—and your instructor is horrified by your choice.

This hypothetical example is consistent with studies of groups making decisions that involve risk. Common sense notions suggest that groups exert a moderating, subduing effect on their members. However, when researchers looked at groups closely, they discovered many groups shift toward more extreme decisions rather than less extreme decisions after group interaction. Discussion, it turns out, doesn't moderate people's judgments after all. Instead, it leads to **group polarization**: judgments made after group discussion will be more extreme in the same direction as the average of individual judgments made prior to discussion (**Myers & Lamm, 1976**). If a majority of members feel that taking risks is more acceptable than exercising caution, then the group will become riskier after a discussion. For example, in France, where

people generally like their government but dislike Americans, group discussion improved their attitude toward their government but exacerbated their negative opinions of Americans (**Moscovici & Zavalloni, 1969**). Similarly, prejudiced people who discussed racial issues with other prejudiced individuals became even more negative, but those who were relatively unprejudiced exhibited even more acceptance of diversity when in groups (**Myers & Bishop, 1970**).

Common Knowledge Effect

One of the advantages of making decisions in groups is the group's greater access to information. When seeking a solution to a problem, group members can put their ideas on the table and share their knowledge and judgments with each other through discussions. But all too often groups spend much of their discussion time examining common

knowledge—information

that two or more group

members know in common—rather than unshared information. **This common knowledge effect** will result in a bad outcome if something known by only one or two group members is very important.

Researchers have studied this bias using the *hidden profile task*. On such tasks, information known to many of the group members suggests that one alternative, say Option A, is best. However, Option B is definitely the better choice, but all the



Groupthink helps us blend in and feel accepted and validated but it can also lead to problems. [Image: CC0 Public Domain, <https://goo.gl/m25gce>]

facts that support Option B are only known to individual groups members—they are not common knowledge in the group. As a result, the group will likely spend most of its time reviewing the factors that favor Option A, and never discover any of its drawbacks. In consequence, groups often perform poorly when working on problems with nonobvious solutions that can only be identified by extensive information sharing (Stasser & Titus, 1987).

Groupthink

Groups sometimes make spectacularly bad decisions. In 1961, a special advisory committee to President John F. Kennedy planned and implemented a covert invasion of Cuba at the Bay of Pigs that ended in total disaster. In 1986, NASA carefully, and incorrectly, decided to launch the Challenger space shuttle in temperatures that were too cold.

Irving Janis (1982), intrigued by these kinds of blundering groups, carried out a number of case studies of such groups: the military experts that planned the defense of Pearl Harbor; Kennedy's Bay of Pigs planning group; the presidential team that escalated the war in Vietnam. Each group, he concluded, fell prey to a distorted style of thinking that rendered the group members incapable of making a rational decision. Janis labeled this syndrome **groupthink**: "a mode of thinking that people engage in when they are deeply involved in a cohesive in-group, when the members' strivings for unanimity override their motivation to realistically appraise alternative courses of action" (p. 9).

Janis identified both the telltale symptoms that signal the group is experiencing groupthink and the interpersonal factors that combine to cause groupthink. To Janis, groupthink is a disease that infects healthy groups, rendering them inefficient and unproductive. And like the physician who searches for

symptoms that distinguish one disease from another, Janis identified a number of symptoms that should serve to warn members that they may be falling prey to groupthink. These symptoms include overestimating the group's skills and wisdom, biased perceptions and evaluations of other groups and people who are outside of the group, strong conformity pressures within the group, and poor decision-making methods.

Janis also singled out four group-level factors that combine to cause groupthink: cohesion, isolation, biased leadership, and decisional stress.

- *Cohesion*: Groupthink only occurs in cohesive groups. Such groups have many advantages over groups that lack unity. People enjoy their membership much more in cohesive groups, they are less likely to abandon the group, and they work harder in pursuit of the group's goals. But extreme cohesiveness can be dangerous. When cohesiveness intensifies, members become more likely to accept the goals, decisions, and norms of the group without reservation. Conformity pressures also rise as members become reluctant to say or do anything that goes against the grain of the group, and the number of internal disagreements—necessary for good decision making—decreases.
- *Isolation*. Groupthink groups too often work behind closed doors, keeping out of the limelight. They isolate themselves from outsiders and refuse to modify their beliefs to bring them into line with society's beliefs. They avoid leaks by maintaining strict confidentiality and working only with people who are members of their group.
- *Biased leadership*. A biased leader who exerts too much authority over group members can increase conformity pressures and railroad decisions. In groupthink groups, the

leader determines the agenda for each meeting, sets limits on discussion, and can even decide who will be heard.

- *Decisional stress.* Groupthink becomes more likely when the group is stressed, particularly by time pressures. When groups are stressed they minimize their discomfort by quickly choosing a plan of action with little argument or dissension. Then, through collective discussion, the group members can rationalize their choice by exaggerating the positive consequences, minimizing the possibility of negative outcomes, concentrating on minor details, and overlooking larger issues.

You and Your Groups



Even groups that like one another and work well together in most situations can be victims of groupthink or the common knowledge effect. But knowing that these pitfalls exist is the first step to overcoming them. [Image: CC0 Public Domain, <https://goo.gl/m25gce>]

Most of us belong to at least one group that must make decisions from time to time: a community group that needs to choose a fund-raising project; a union or employee group that must ratify a new contract; a family that must discuss your college plans; or the staff of a high school discussing ways to deal with the potential for violence during football games. Could these kinds of groups experience

groupthink? Yes they could, if the symptoms of groupthink discussed above are present, combined with other contributing causal factors, such as cohesiveness, isolation,

biased leadership, and stress. To avoid polarization, the common knowledge effect, and groupthink, groups should strive to emphasize open inquiry of all sides of the issue while admitting the possibility of failure. The leaders of the group can also do much to limit groupthink by requiring full discussion of pros and cons, appointing devil's advocates, and breaking the group up into small discussion groups.

If these precautions are taken, your group has a much greater chance of making an informed, rational decision. Furthermore, although your group should review its goals, teamwork, and decision-making strategies, the human side of groups—the strong friendships and bonds that make group activity so enjoyable—shouldn't be overlooked. Groups have instrumental, practical value, but also emotional, psychological value. In groups we find others who appreciate and value us. In groups we gain the support we need in difficult times, but also have the opportunity to influence others. In groups we find evidence of our self-worth, and secure ourselves from the threat of loneliness and despair. For most of us, groups are the secret source of well-being.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Collective self-esteem

Feelings of self-worth that are based on evaluation of relationships with others and membership in social groups.

Common knowledge effect

The tendency for groups to spend more time discussing

information that all members know (shared information) and less time examining information that only a few members know (unshared).

Group cohesion

The solidarity or unity of a group resulting from the development of strong and mutual interpersonal bonds among members and group-level forces that unify the group, such as shared commitment to group goals.

Group polarization

The tendency for members of a deliberating group to move to a more extreme position, with the direction of the shift determined by the majority or average of the members' predeliberation preferences.

Groupthink

A set of negative group-level processes, including illusions of invulnerability, self-censorship, and pressures to conform, that occur when highly cohesive groups seek concurrence when making a decision.

Ostracism

Excluding one or more individuals from a group by reducing or eliminating contact with the person, usually by ignoring, shunning, or explicitly banishing them.

Shared mental model

Knowledge, expectations, conceptualizations, and other cognitive representations that members of a group have in common pertaining to the group and its members, tasks, procedures, and resources.

Social comparison

The process of contrasting one's personal qualities and outcomes, including beliefs, attitudes, values, abilities, accomplishments, and experiences, to those of other

people.

Social facilitation

Improvement in task performance that occurs when people work in the presence of other people.

Social identity theory

A theoretical analysis of group processes and intergroup relations that assumes groups influence their members' self-concepts and self-esteem, particularly when individuals categorize themselves as group members and identify with the group.

Social loafing

The reduction of individual effort exerted when people work in groups compared with when they work alone.

Sociometer model

A conceptual analysis of self-evaluation processes that theorizes self-esteem functions to psychologically monitor of one's degree of inclusion and exclusion in social groups.

Teamwork

The process by which members of the team combine their knowledge, skills, abilities, and other resources through a coordinated series of actions to produce an outcome.

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67. Prejudice, Discrimination, and Stereotyping

Original chapter by Susan T. Fiske, adapted by the Queen's University Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

People are often biased against others outside of their own social group, showing prejudice (emotional bias), stereotypes (cognitive bias), and discrimination (behavioral bias). In the past, people used to be more explicit with their biases, but during the 20th century, when it became less socially acceptable to exhibit bias, such things like prejudice, stereotypes, and discrimination became more subtle (automatic, ambiguous, and ambivalent). In the 21st century, however, with social group categories even more complex, biases may be transforming once again.

Learning Objectives

- Distinguish prejudice, stereotypes, and discrimination.
- Distinguish old-fashioned, blatant biases from

contemporary, subtle biases.

- Understand old-fashioned biases such as social dominance orientation and right-wing authoritarianism.
- Understand subtle, unexamined biases that are automatic, ambiguous, and ambivalent.
- Understand 21st century biases that may break down as identities get more complicated.

Introduction



You are an individual, full of beliefs, identities, and more that help make you unique. You don't want to be labeled just by your gender or race or religion. But as complex as we perceive ourselves to be, we often define others merely by their most distinct social group. [Image: caseorganic, <https://goo.gl/PuLI4E>, CC BY-NC 2.0, <https://goo.gl/VnKIK8>]

Even in one's own family, everyone wants to be seen for who they are, not as "just another typical X." But still, people put other people into groups, using that label to inform their evaluation of the person as a whole—a process that can result in serious consequences. This module focuses on biases against social groups, which social psychologists sort into emotional **prejudices**, mental **stereotypes**, and behavioral **discrimination**. These three aspects of bias are related, but they each can occur separately from the

others (**Dovidio & Gaertner, 2010; Fiske, 1998**). For example, sometimes people have a negative, emotional reaction to a social group (prejudice) without knowing even the most superficial reasons to dislike them (stereotypes). This module

shows that today's biases are not yesterday's biases in many ways, but at the same time, they are troublingly similar. First, we'll discuss old-fashioned biases that might have belonged to our grandparents and great-grandparents—or even the people nowadays who have yet to leave those wrongful times. Next, we will discuss late 20th century biases that affected our parents and still linger today. Finally, we will talk about today's 21st century biases that challenge fairness and respect for all.

Old-fashioned Biases: Almost Gone

You would be hard pressed to find someone today who openly admits they don't believe in equality. Regardless of one's demographics, most people believe everyone is entitled to the same, natural rights. However, as much as we now collectively believe this, not too far back in our history, this ideal of equality was an unpracticed sentiment. Of all the countries in the world, only a few have equality in their constitution, and those who do, originally defined it for a select group of people.

At the time, old-fashioned biases were simple: people openly put down those not from their own group. For example, just 80 years ago, American college students unabashedly thought Turkish people were “cruel, very religious, and treacherous” (**Katz & Braly, 1933**). So where did they get those ideas, assuming that most of them had never met anyone from Turkey? Old-fashioned stereotypes were overt, unapologetic, and expected to be shared by others—what we now call “blatant biases.”

Blatant biases are conscious beliefs, feelings, and behavior that people are perfectly willing to admit, which mostly express hostility toward other groups (outgroups) while unduly favoring one's own group (in-group). For example, organizations that preach contempt for other races (and praise

for their own) is an example of a blatant bias. And scarily, these blatant biases tend to run in packs: People who openly hate one outgroup also hate many others. To illustrate this pattern, we turn to two personality scales next.

Social Dominance Orientation



People with a social dominance orientation are more likely to be attracted to certain types of careers, such as law enforcement, that maintain group hierarchies.
[Image: Thomas Hawk, <https://goo.gl/qWQ7JE>, CC BY-NC 2.0, <https://goo.gl/VnKIK8>]

Social dominance orientation (SDO) describes a belief that group hierarchies are inevitable in all societies and are even a good idea to maintain order and stability (**Sidanius & Pratto, 1999**). Those who score high on SDO believe that some groups are inherently better than others, and because of this, there is no such thing as group “equality.” At the same time, though, SDO is not just about being personally dominant and controlling of others;

SDO describes a preferred arrangement of groups with some on top (preferably one’s own group) and some on the bottom. For example, someone high in SDO would likely be upset if someone from an outgroup moved into his or her neighborhood. It’s not that the person high in SDO wants to “control” what this outgroup member does; it’s that moving into this “nice neighborhood” disrupts the social hierarchy the person high in SDO believes in (i.e. living in a nice neighborhood denotes one’s place in the social hierarchy—a

place reserved for one's in-group members). Although research has shown that people higher in SDO are more likely to be politically conservative, there are other traits that more strongly predict one's SDO. For example, researchers have found that those who score higher on SDO are usually lower than average on tolerance, empathy, altruism, and community orientation. In general, those high in SDO have a strong belief in work ethic—that hard work always pays off and leisure is a waste of time. People higher on SDO tend to choose and thrive in occupations that maintain existing group hierarchies (police, prosecutors, business), compared to those lower in SDO, who tend to pick more equalizing occupations (social work, public defense, psychology).The point is that SDO—a preference for inequality as normal and natural—also predicts endorsing the superiority of certain groups: men, native-born residents, heterosexuals, and believers in the dominant religion. This means seeing women, minorities, homosexuals, and non-believers as inferior. Understandably, the first list of groups tend to score higher on SDO, while the second group tends to score lower. For example, the SDO gender difference (men higher, women lower) appears all over the world.At its heart, SDO rests on a fundamental belief that the world is tough and competitive with only a limited number of resources. Thus, those high in SDO see groups as battling each other for these resources, with winners at the top of the social hierarchy and losers at the bottom (see Table 1).

	Social Dominance Orientation	Right-Wing Authoritarianism
Core Belief	Groups compete for economic resources	Groups compete over values
Intergroup Belief	Group hierarchies are inevitable, good	Groups must follow authority
Ingroup Belief	Ingroup must be tough, competitive	Ingroup must unite, protect
Outgroup Belief	"They" are trying to beat "us"	"They" have bad values

Table 1. Old-Fashioned Biases

Right-wing Authoritarianism

Right-wing authoritarianism (RWA) focuses on value conflicts, whereas SDO focuses on the economic ones. That is, RWA endorses respect for obedience and authority in the service of group conformity (Altemeyer, 1988). Returning to an example from earlier, the homeowner who's high in SDO may dislike the outgroup member moving into his or her neighborhood because it "threatens" one's economic resources (e.g. lowering the value of one's house; fewer openings in the school; etc.). Those high in RWA may equally dislike the outgroup member moving into the neighborhood but for different reasons. Here, it's because this outgroup member brings in values or beliefs that the person high in RWA disagrees with, thus "threatening" the collective values of his or her group. RWA respects group unity over individual preferences, wanting to maintain group values in the face of differing opinions. Despite its name, though, RWA is not necessarily limited to people on the right (conservatives). Like SDO, there does appear to be an association between this personality scale (i.e. the preference for order, clarity, and conventional values) and conservative beliefs. However, regardless of political ideology, RWA focuses on groups' competing frameworks of values. Extreme scores on RWA predict biases against outgroups while demanding in-group loyalty and conformity. Notably, the combination of high RWA and high SDO predicts joining hate groups that openly endorse aggression against minority groups, immigrants, homosexuals, and believers in non-dominant religions (Altemeyer, 2004).

20th Century Biases: Subtle but Significant

Unfortunately, although many have hoped that overt prejudice and prejudice behaviours were a part of our history, it is clear that they are not. These are not the only form of damaging biases, though. Sometimes biases exist in people; they're just more subtle. These **subtle biases** are unexamined and sometimes unconscious but real in their consequences. They are automatic, ambiguous, and ambivalent, and nonetheless are biased, unfair, and disrespectful to the belief in equality.

Automatic Biases



An actual screenshot from an IAT (Implicit Association Test) that is designed to test a person's reaction time (measured in milliseconds) to an array of stimuli that are presented on the screen. This particular item is testing an individual's unconscious reaction towards members of various ethnic groups. [Image: Courtesy of Anthony Greenwald from Project Implicit]

Most people like themselves well enough, and most people identify themselves as members of certain groups but not others. Logic suggests, then, that because we like ourselves, we therefore like the groups we associate with more, whether those groups are our hometown, school, religion, gender, or ethnicity. Liking yourself and your groups is human nature. The larger issue, however, is that own-group preference often results in liking other groups less. And whether you recognize this “favoritism” as wrong, this trade-off is

relatively **automatic**, that is, unintended, immediate, and irresistible. Social psychologists have developed several ways to measure this relatively automatic own-group preference, the most famous being the **Implicit Association Test** (IAT; Greenwald, Banaji, Rudman, Farnham, Nosek, & Mellott, 2002; Greenwald, McGhee, & Schwartz, 1998). The test itself is rather simple and you can experience it yourself if you Google “implicit” or go to understandingprejudice.org. Essentially, the IAT is done on the computer and measures how quickly you can sort words or pictures into different categories. For example, if you were asked to categorize “ice cream” as good or bad, you would quickly categorize it as good. However, imagine if every time you ate ice cream, you got a brain freeze.

When it comes time to categorize ice cream as good or bad, you may still categorize it as “good,” but you will likely be a little slower in doing so compared to someone who has nothing but positive thoughts about ice cream. Related to group biases, people may explicitly claim they don’t discriminate against outgroups—and this is very likely true. However, when they’re given this computer task to categorize people from these outgroups, that automatic or unconscious hesitation (a result of having mixed evaluations about the outgroup) will show up in the test. And as countless studies have revealed, people are mostly faster at pairing their own group with good categories, compared to pairing others’ groups. In fact, this finding generally holds regardless if one’s group is measured according race, age, religion, nationality, and even temporary, insignificant memberships. This all-too-human tendency would remain a mere interesting discovery except that people’s reaction time on the IAT predicts actual feelings about individuals from other groups, decisions about them, and behavior toward them, especially nonverbal behavior (**Greenwald, Poehlman, Uhlmann, & Banaji, 2009**). For example, although a job interviewer may not be “blatantly biased,” his or her “automatic or implicit biases” may result in unconsciously acting distant and indifferent, which can have devastating effects on the hopeful interviewee’s ability to perform well (**Word, Zanna, & Cooper, 1973**). Although this is unfair, sometimes the automatic associations—often driven by society’s stereotypes—trump our own, explicit values (**Devine, 1989**). And sadly, this can result in consequential discrimination, such as allocating fewer resources to disliked outgroups (**Rudman & Ashmore, 2009**). See Table 2 for a summary of this section and the next two sections on subtle biases.

Type of Bias	Example	What It Shows
Automatic	Implicit Association Test	People link “good” & ingroup, “bad” & outgroup
Ambiguous	Social identity theory Self-categorized theory Aversive racism	People favor ingroup, distance from outgroup Same but emphasizes self as a member of ingroup People avoid outgroup, avoid their own prejudices
Ambivalent	Stereotype Content Model	People divide groups by warmth and competence

Table 2: Subtle Biases

Ambiguous Biases

As the IAT indicates, people’s biases often stem from the spontaneous tendency to favor their own, at the expense of the other. **Social identity theory** (Tajfel, Billig, Bundy, & Flament, 1971) describes this tendency to favor one’s own in-group over another’s outgroup. And as a result, outgroup disliking stems from this in-group liking (Brewer & Brown, 1998). For example, if two classes of children want to



Whether we are aware of it or not (and usually we’re not), we sort the world into “us” and “them” categories. We are more likely to treat with bias or discrimination anyone we feel is outside our own group. [Image: Keira McPhee, <https://goo.gl/gkaKBe>, CC BY 2.0, <https://goo.gl/BRvSA7>]

play on the same soccer field, the classes will come to dislike each other not because of any real, objectionable traits about the other group. The dislike originates from each class’s favoritism toward itself and the fact that only one group can play on the soccer field at a time. With this preferential perspective for one’s own group, people are not punishing the other one so much as neglecting it in favor of their own.

However, to justify this preferential treatment, people will often exaggerate the differences between their in-group and the outgroup. In turn, people see the outgroup as more similar in personality than they are. This results in the perception that “they” really differ from us, and “they” are all alike. Spontaneously, people categorize people into groups just as we categorize furniture or food into one type or another. The difference is that we people inhabit categories ourselves, as **self-categorization theory** points out (Turner, 1975). Because the attributes of group categories can be either good or bad, we tend to favor the groups with people like us and incidentally disfavor the others. In-group favoritism is an ambiguous form of bias because it disfavors the outgroup by exclusion. For example, if a politician has to decide between funding one program or another, s/he may be more likely to give resources to the group that more closely represents his in-group. And this life-changing decision stems from the simple, natural human tendency to be more comfortable with people like yourself. A specific case of comfort with the ingroup is called aversive racism, so-called because people do not like to admit their own racial biases to themselves or others (Dovidio & Gaertner, 2010). Tensions between, say, a White person’s own good intentions and discomfort with the perhaps novel situation of interacting closely with a Black person may cause the White person to feel uneasy, behave stiffly, or be distracted. As a result, the White person may give a good excuse to avoid the situation altogether and prevent any awkwardness that could have come from it. However, such a reaction will be ambiguous to both parties and hard to interpret. That is, was the White person right to avoid the situation so that neither person would feel uncomfortable? Indicators of **aversive racism** correlate with discriminatory behavior, despite being the ambiguous result of good intentions gone bad.

Bias Can Be Complicated – Ambivalent Biases

Not all stereotypes of outgroups are all negative, though they may still be unwanted. For example, ethnic Asians living in the United States are commonly referred to as the “model minority” because of their perceived success in areas such as education, income, and social stability. Another example includes people who feel benevolent toward traditional women but hostile toward nontraditional women. Or even ageist people who feel respect toward older adults but, at the same time, worry about the burden they place on public welfare programs. A simple way to understand these mixed feelings, across a variety of groups, results from the **Stereotype Content Model (Fiske, Cuddy, & Glick, 2007)**.

When people learn about a new group, they first want to know if its intentions of the people in this group are for good or ill. Like the guard at night: “Who goes there, friend or foe?” If the other group has good, cooperative intentions, we view them as warm and trustworthy and often consider them part of “our side.” However, if the other group is cold and competitive or full of exploiters, we often view them as a threat and treat them accordingly. After learning the group’s intentions, though, we also want to know whether they are competent enough to act on them (if they are incompetent, or unable, their intentions matter less). These two simple dimensions—warmth and competence—together map how groups relate to each other in society.

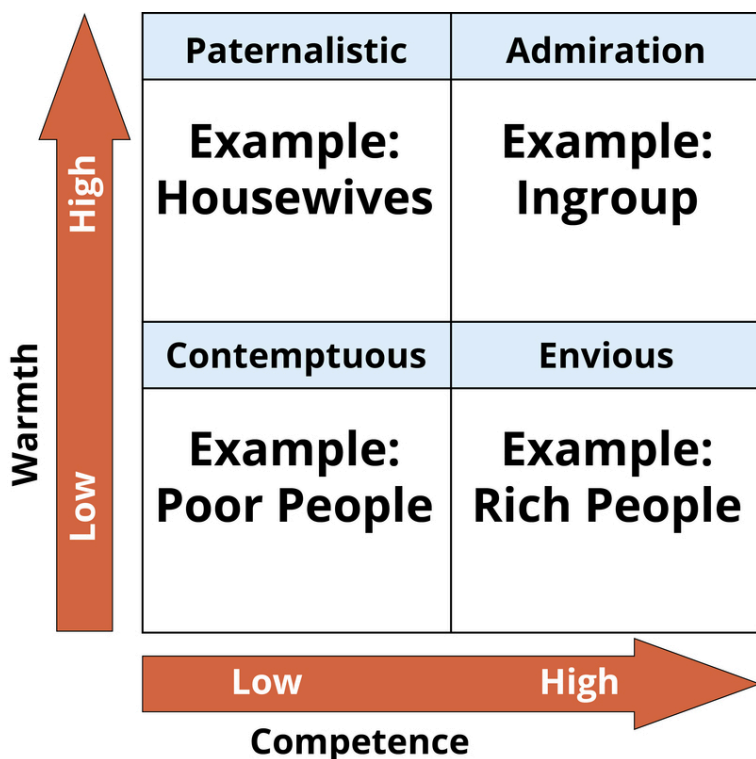


Figure 1: Stereotype Content Model – 4 kinds of stereotypes that form from perceptions of competence and warmth

There are common stereotypes of people from all sorts of categories and occupations that lead them to be classified along these two dimensions. For example, a stereotypical “housewife” would be seen as high in warmth but lower in competence. This is not to suggest that actual housewives are not competent, of course, but that they are not widely admired for their competence in the same way as scientific pioneers, trendsetters, or captains of industry. At another end of the spectrum are homeless people and drug addicts, stereotyped as not having good intentions (perhaps exploitative for not

trying to play by the rules), and likewise being incompetent (unable) to do anything useful. These groups reportedly make society more disgusted than any other groups do.

Some group stereotypes are mixed, high on one dimension and low on the other. Groups stereotyped as competent but not warm, for example, include rich people and outsiders good at business. These groups that are seen as “competent but cold” make people feel some envy, admitting that these others may have some talent but resenting them for not being “people like us.” The “model minority” stereotype mentioned earlier includes people with this excessive competence but deficient sociability.

The other mixed combination is high warmth but low competence. Groups who fit this combination include older people and disabled people. Others report pitying them, but only so long as they stay in their place. In an effort to combat this negative stereotype, disability- and elderly-rights activists try to eliminate that pity, hopefully gaining respect in the process.

Altogether, these four kinds of stereotypes and their associated emotional prejudices (pride, disgust, envy, pity) occur all over the world for each of society’s own groups. These maps of the group terrain predict specific types of discrimination for specific kinds of groups, underlining how bias is not exactly equal opportunity.

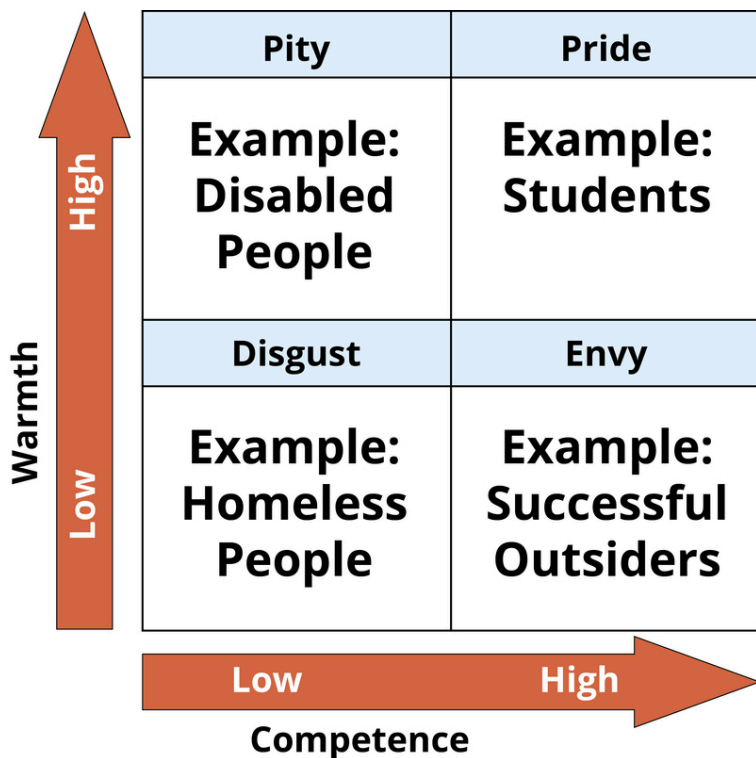


Figure 2: Combinations of perceived warmth and confidence and the associated behaviors/emotional prejudices.

Conclusion: 21st Century Prejudices

As the world becomes more interconnected, more and more people are encountering greater diversity of others in everyday life. Categories are becoming more and more uncertain, unclear, volatile, and complex (Bodenhausen & Peery, 2009). People's identities are multifaceted, intersecting across gender, race, class, age, region, and more.

Inclusive Queen's

Prejudice, stereotypes, and discrimination are present in our society, and eliminating such bias requires ongoing and sustained effort. Queen's University has compiled resources to support our common pursuit of a community that is welcoming, inclusive, and safe for all of our community members. <https://www.queensu.ca/inclusive/content/home>

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Automatic bias

Automatic biases are unintended, immediate, and irresistible.

Aversive racism

Aversive racism is unexamined racial bias that the person does not intend and would reject, but that avoids inter-racial contact.

Blatant biases

Blatant biases are conscious beliefs, feelings, and behavior that people are perfectly willing to admit, are mostly hostile, and openly favor their own group.

Discrimination

Discrimination is behavior that advantages or disadvantages people merely based on their group membership.

Implicit Association Test

Implicit Association Test (IAT) measures relatively automatic biases that favor own group relative to other groups.

Prejudice

Prejudice is an evaluation or emotion toward people merely based on their group membership.

Right-wing authoritarianism

Right-wing authoritarianism (RWA) focuses on value conflicts but endorses respect for obedience and authority in the service of group conformity.

Self-categorization theory

Self-categorization theory develops social identity theory's point that people categorize themselves, along with each other into groups, favoring their own group.

Social dominance orientation

Social dominance orientation (SDO) describes a belief that group hierarchies are inevitable in all societies and even good, to maintain order and stability.

Social identity theory

Social identity theory notes that people categorize each other into groups, favoring their own group.

Stereotype Content Model

Stereotype Content Model shows that social groups are viewed according to their perceived warmth and competence.

Stereotypes

Stereotype is a belief that characterizes people based merely on their group membership.

Subtle biases

Subtle biases are automatic, ambiguous, and ambivalent, but real in their consequences.

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PSYC 100 XXIV

RELATIONSHIPS AND SELF-IDENTITY

68. Self and Identity

Original Chapter by Dan P. McAdams
adapted by the Queen's University
Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below. We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen’s Student Academic Success Services, at the following link:
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For human beings, the self is what happens when “I” encounters “Me.” The central psychological question of selfhood, then, is this: How does a person apprehend and understand who he or she is? Over the past 100 years, psychologists have approached the study of self (and the related concept of identity) in many different ways, but three central metaphors for the self repeatedly emerge. First, the self may be seen as a social actor, who enacts roles and displays traits by performing behaviors in the presence of others. Second, the self is a motivated agent, who acts upon inner desires and formulates goals, values, and plans to guide behavior in the future. Third, the self eventually becomes an autobiographical author, too, who takes stock of life — past, present, and future — to create a story about who I am, how I came to be, and where my life may be going. This module briefly reviews central ideas and research findings on the self as an actor, an agent, and an author, with an emphasis on how these features of selfhood develop over the human life course.

Learning Objectives

- Explain the basic idea of reflexivity in human selfhood—how the “I” encounters and makes sense of itself (the “Me”).
- Describe fundamental distinctions between three different perspectives on the self: the self as actor, agent, and author.
- Describe how a sense of self as a social actor emerges around the age of 2 years and how it develops going forward.
- Describe the development of the self’s sense of motivated agency from the emergence of the child’s theory of mind to the articulation of life goals and values in adolescence and beyond.
- Define the term narrative identity, and explain what psychological and cultural functions narrative identity serves.

Introduction

In the Temple of Apollo at Delphi, the ancient Greeks inscribed the words: “Know thyself.” For at least 2,500 years, and probably longer, human beings have pondered the meaning of the ancient aphorism. Over the past century, psychological scientists have joined the effort. They have formulated many theories and tested countless hypotheses that speak to the central question of human selfhood: *How does a person know who he or she is?*



We work on ourselves as we would any other interesting project. And when we do we generally focus on three psychological categories – The Social Actor, The Motivated Agent, and The Autobiographical Author. [Image: MakuKulden, <https://goo.gl/sMUsnJ>, CC BY-NC 2.0, <https://goo.gl/VnKlK8>]

The ancient Greeks seemed to realize that the self is inherently **reflexive**—it reflects back on itself. In the disarmingly simple idea made famous by the great psychologist William James (1892/1963), the self is what happens when “I” reflects back upon “Me.” The self is both the I and the Me—it is the knower, and it is what the knower knows when the knower reflects upon itself. When you look back at yourself, what do you see? When you look inside, what do you find? Moreover, when

you try to *change* your self in some way, what is it that you are trying to change? The philosopher Charles Taylor (1989) describes the self as a reflexive *project*. In modern life, Taylor argues, we often try to manage, discipline, refine, improve, or develop the self. We *work on* our selves, as we might work on any other interesting project. But what exactly is it that we work on?

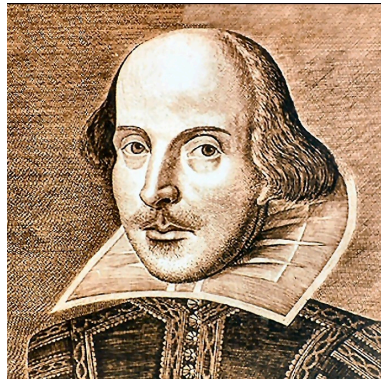
Imagine for a moment that you have decided to improve *yourself*. You might, say, go on a diet to improve your appearance. Or you might decide to be nicer to your mother, in order to improve that important social role. Or maybe the problem is at work—you need to find a better job or go back to school to prepare for a different career. Perhaps you just need to work harder. Or get organized. Or recommit yourself to religion. Or maybe the key is to begin thinking about your whole life story in a completely different way, in a way that

you hope will bring you more happiness, fulfillment, peace, or excitement.

Although there are many different ways you might reflect upon and try to improve the self, it turns out that many, if not most, of them fall roughly into three broad psychological categories (**McAdams & Cox, 2010**). The I may encounter the Me as (a) a social actor, (b) a motivated agent, or (c) an autobiographical author.

The Social Actor

Shakespeare tapped into a deep truth about human nature when he famously wrote, “All the world’s a stage, and all the men and women merely players.” He was wrong about the “merely,” however, for there is nothing more important for human adaptation than the manner in which we perform our roles as actors in the everyday theatre of social life. What Shakespeare may have sensed but could not have



In some ways people are just like actors on stage. We play roles and follow scripts every day. [Image: Brian, <https://goo.gl/z0VI3t>, CC BY-SA 2.0, <https://goo.gl/i4CXf5>]

fully understood is that human beings evolved to live in social groups. Beginning with Darwin (**1872/1965**) and running through contemporary conceptions of human evolution, scientists have portrayed human nature as profoundly social (**Wilson, 2012**). For a few million years, *Homo sapiens* and their evolutionary forerunners have survived and flourished by virtue of their ability to live and work together in complex social groups, cooperating with each other to solve problems and

overcome threats and competing with each other in the face of limited resources. As social animals, human beings strive to *get along* and *get ahead* in the presence of each other (**Hogan, 1982**). Evolution has prepared us to care deeply about social acceptance and social status, for those unfortunate individuals who do not get along well in social groups or who fail to attain a requisite status among their peers have typically been severely compromised when it comes to survival and reproduction. It makes consummate evolutionary sense, therefore, that the human “I” should apprehend the “Me” first and foremost as a *social actor*.

For human beings, the sense of the self as a social actor begins to emerge around the age of 18 months. Numerous studies have shown that by the time they reach their second birthday most toddlers recognize themselves in mirrors and other reflecting devices (**Lewis & Brooks-Gunn, 1979; Rochat, 2003**). What they see is an embodied actor who moves through space and time. Many children begin to use words such as “me” and “mine” in the second year of life, suggesting that the I now has linguistic labels that can be applied reflexively to itself: I call myself “me.” Around the same time, children also begin to express social emotions such as embarrassment, shame, guilt, and pride (**Tangney, Stuewig, & Mashek, 2007**). These emotions tell the social actor how well he or she is performing in the group. When I do things that win the approval of others, I feel proud of myself. When I fail in the presence of others, I may feel embarrassment or shame. When I violate a social rule, I may experience guilt, which may motivate me to make amends.

Many of the classic psychological theories of human selfhood point to the second year of life as a key developmental period. For example, Freud (**1923/1961**) and his followers in the psychoanalytic tradition traced the emergence of an autonomous **ego** back to the second year. Freud used the term “ego” (in German *das Ich*, which also translates into “the I”)

to refer to an executive self in the personality. Erikson (1963) argued that experiences of trust and interpersonal attachment in the first year of life help to consolidate the autonomy of the ego in the second. Coming from a more sociological perspective, Mead (1934) suggested that the I comes to know the Me through reflection, which may begin quite literally with mirrors but later involves the reflected appraisals of others. I come to know who I am as a social actor, Mead argued, by noting how *other people* in my social world react to my performances. In the development of the self as a social actor, other people function like mirrors—they reflect who I am back to me.

Research has shown that when young children begin to make attributions about themselves, they start simple (Harter, 2006). At age 4, Jessica knows that she has dark hair, knows that she lives in a white house, and describes herself to others in terms of simple behavioral *traits*. She may say that she is “nice,” or “helpful,” or that she is “a good girl most of the time.” By the time, she hits fifth grade (age 10), Jessica sees herself in more complex ways, attributing traits to the self such as “honest,” “moody,” “outgoing,” “shy,” “hard-working,” “smart,” “good at math but not gym class,” or “nice except when I am around my annoying brother.” By late childhood and early adolescence, the personality traits that people attribute to themselves, as well as those attributed to them by others, tend to correlate with each other in ways that conform to a well-established taxonomy of five broad trait domains, repeatedly derived in studies of adult personality and often called the **Big Five**: (1) extraversion, (2) neuroticism, (3) agreeableness, (4) conscientiousness, and (5) openness to experience (Roberts, Wood, & Caspi, 2008). By late childhood, moreover, self-conceptions will likely also include important social *roles*: “I am a good student,” “I am the oldest daughter,” or “I am a good friend to Sarah.”

Traits and roles, and variations on these notions, are the main

currency of the **self as social actor** (McAdams & Cox, 2010). Trait terms capture perceived consistencies in social performance. They convey what I reflexively perceive to be my overall acting style, based in part on how I think others see me as an actor in many different social situations. Roles capture the quality, as I perceive it, of important structured relationships in my life. Taken together, traits and roles make up the main features of my **social reputation**, as I apprehend it in my own mind (Hogan, 1982).

If you have ever tried hard to change yourself, you may have taken aim at your social reputation, targeting your central traits or your social roles. Maybe you woke up one day and decided that you must become a more optimistic and emotionally upbeat person. Taking into consideration the reflected appraisals of others, you realized that even your friends seem to avoid you because you bring them down. In addition, it feels bad to feel so bad all the time: Wouldn't it be better to feel good, to have more energy and hope? In the language of traits, you have decided to "work on" your "neuroticism." Or maybe instead, your problem is the trait of "conscientiousness": You are undisciplined and don't work hard enough, so you resolve to make changes in that area. Self-improvement efforts such as these—aimed at changing one's traits to become a more effective social actor—are sometimes successful, but they are very hard—kind of like dieting. Research suggests that broad traits tend to be stubborn, resistant to change, even with the aid of psychotherapy. However, people often have more success working directly on their social roles. To become a more effective social actor, you may want to take aim at the important roles you play in life. What can I do to become a better son or daughter? How can I find new and meaningful roles to perform at work, or in my family, or among my friends, or in my church and community? By doing concrete things that enrich your performances in important social roles, you may begin to see yourself in a new light, and others will notice

the change, too. Social actors hold the potential to transform their performances across the human life course. Each time you walk out on stage, you have a chance to start anew.

The Motivated Agent



When we observe others we only see how they act but are never able to access the entirety of their internal experience. [Image: CCO Public Domain, <https://goo.gl/m25gce>]

Whether we are talking literally about the theatrical stage or more figuratively, as I do in this module, about the everyday social environment for human behavior, observers can never fully know what is in the actor's head, no matter how closely they watch. We can see actors act, but we cannot know for sure what they want or what they value, unless they tell us straightaway. As a social actor, a person may come

across as friendly and compassionate, or cynical and mean-spirited, but in neither case can we infer their motivations from their traits or their roles. What does the friendly person want? What is the cynical father trying to achieve? Many broad psychological theories of the self prioritize the motivational qualities of human behavior—the inner needs, wants, desires, goals, values, plans, programs, fears, and aversions that seem to give behavior its direction and purpose (Bandura, **1989**; Deci & Ryan, **1991**; Markus & Nurius, **1986**). These kinds of theories explicitly conceive of the self as a *motivated agent*.

To be an agent is to act with direction and purpose, to move forward into the future in pursuit of self-chosen and valued

goals. In a sense, human beings are agents even as infants, for babies can surely act in goal-directed ways. By age 1 year, moreover, infants show a strong preference for observing and imitating the goal-directed, intentional behavior of others, rather than random behaviors (**Woodward, 2009**). Still, it is one thing to act in goal-directed ways; it is quite another for the I to know itself (the Me) as an intentional and purposeful force who moves forward in life in pursuit of self-chosen goals, values, and other desired end states. In order to do so, the person must first realize that people indeed have desires and goals in their minds and that these inner desires and goals *motivate* (initiate, energize, put into motion) their behavior. According to a strong line of research in developmental psychology, attaining this kind of understanding means acquiring a **theory of mind** (**Wellman, 1993**), which occurs for most children by the age of 4. Once a child understands that other people's behavior is often motivated by inner desires and goals, it is a small step to apprehend the self in similar terms.

Building on theory of mind and other cognitive and social developments, children begin to construct the self as a motivated agent in the elementary school years, layered over their still-developing sense of themselves as social actors. Theory and research on what developmental psychologists call **the age 5-to-7 shift** converge to suggest that children become more planful, intentional, and systematic in their pursuit of valued goals during this time (**Sameroff & Haith, 1996**). Schooling reinforces the shift in that teachers and curricula place increasing demands on students to work hard, adhere to schedules, focus on goals, and achieve success in particular, well-defined task domains. Their relative success in achieving their most cherished goals, furthermore, goes a long way in determining children's **self-esteem** (**Robins, Tracy, & Trzesniewski, 2008**). Motivated agents feel good about themselves to the extent they believe that they are making

good progress in achieving their goals and advancing their most important values.

Goals and values become even more important for the self in adolescence, as teenagers begin to confront what Erikson (1963) famously termed the developmental challenge of **identity**. For adolescents and young adults, establishing a psychologically efficacious identity involves exploring different options with respect to life goals, values, vocations, and intimate relationships and eventually committing to a motivational and ideological agenda for adult life—an integrated and realistic sense of what I want and value in life and how I plan to achieve it (Kroger & Marcia, 2011). Committing oneself to an integrated suite of life goals and values is perhaps the greatest achievement for the **self as motivated agent**. Establishing an adult identity has implications, as well, for how a person moves through life as a social actor, entailing new role commitments and, perhaps, a changing understanding of one's basic dispositional traits. According to Erikson, however, identity achievement is always provisional, for adults continue to work on their identities as they move into midlife and beyond, often relinquishing old goals in favor of new ones, investing themselves in new projects and making new plans, exploring new relationships, and shifting their priorities in response to changing life circumstances (Freund & Riediger, 2006; Josselson, 1996).

There is a sense whereby *any* time you try to change yourself, you are assuming the role of a motivated agent. After all, to strive to change something is inherently what an agent does. However, what particular feature of selfhood you try to change may correspond to your self as actor, agent, or author, or some combination. When you try to change your traits or roles, you take aim at the social actor. By contrast, when you try to change your values or life goals, you are focusing on yourself as a motivated agent. Adolescence and young adulthood are periods in the human life course when many of us focus

attention on our values and life goals. Perhaps you grew up as a traditional Catholic, but now in college you believe that the values inculcated in your childhood no longer function so well for you. You no longer believe in the central tenets of the Catholic Church, say, and are now working to replace your old values with new ones. Or maybe you still want to be Catholic, but you feel that your new take on faith requires a different kind of personal ideology. In the realm of the motivated agent, moreover, changing values can influence life goals. If your new value system prioritizes alleviating the suffering of others, you may decide to pursue a degree in social work, or to become a public interest lawyer, or to live a simpler life that prioritizes people over material wealth. A great deal of the identity work we do in adolescence and young adulthood is about values and goals, as we strive to articulate a personal vision or dream for what we hope to accomplish in the future.

The Autobiographical Author

Even as **the “I”** continues to develop a sense of **the “Me”** as both a social actor and a motivated agent, a third standpoint for selfhood gradually emerges in the adolescent and early-adult years. The third perspective is a response to Erikson’s (1963) challenge of identity. According to Erikson, developing an identity involves more than the exploration of and commitment to life goals and values (the self as motivated agent), and more than committing to new roles and re-evaluating old traits (the self as social actor). It also involves achieving a sense of *temporal continuity* in life—a reflexive understanding of *how I have come to be the person I am becoming*, or put differently, how my past self has developed into my present self, and how my present self will, in turn, develop into an envisioned future self. In his analysis of identity formation in the life of the 15th-century Protestant reformer

Martin Luther, Erikson (1958) describes the culmination of a young adult's search for identity in this way:

"To be adult means among other things to see one's own life in continuous perspective, both in retrospect and prospect. By accepting some definition of who he is, usually on the basis of a function in an economy, a place in the sequence of generations, and a status in the structure of society, the adult is able to *selectively reconstruct his past in such a way that, step for step, it seems to have planned him, or better, he seems to have planned it*. In this sense, psychologically we do choose our parents, our family history, and the history of our kings, heroes, and gods. By making them our own, we maneuver ourselves into the inner position of proprietors, of creators."

— (Erikson, 1958, pp. 111–112; emphasis added).

In this rich passage, Erikson intimates that the development of a mature identity in young adulthood involves the I's ability to construct a retrospective and prospective story about the Me (McAdams, 1985). In their efforts to find a meaningful identity for life, young men and women begin "to selectively reconstruct" their past, as Erikson wrote, and imagine their future to create an integrative life story, or what psychologists today often call a **narrative identity**. A narrative identity is an internalized and evolving story of the self that reconstructs the past and anticipates the future in such a way as to provide a person's life with some degree of unity, meaning, and purpose over time (McAdams, 2008; McLean, Pasupathi, & Pals, 2007). The self typically becomes an *autobiographical author* in the early-adult years, a way of being that is layered over the motivated agent, which is layered over the social actor. In order to provide life with the sense of temporal continuity and deep meaning that Erikson believed identity should confer, we must author a personalized life story that integrates our understanding of who we once were, who we are today, and who we may become in the future. The story helps to explain, for the author and for the author's world, why the social actor

does what it does and why the motivated agent wants what it wants, and how the person as a whole has developed over time, from the past's reconstructed beginning to the future's imagined ending.

By the time they are 5 or 6 years of age, children can tell well-formed stories about personal events in their lives (**Fivush, 2011**). By the end of childhood, they usually have a good sense of what a typical biography contains and how it is sequenced, from birth to death (**Thomsen & Bernsten, 2008**). But it is not until adolescence, research shows, that human beings express advanced storytelling skills and what psychologists call **autobiographical reasoning** (**Habermas & Bluck, 2000; McLean & Fournier, 2008**). In autobiographical reasoning, a narrator is able to derive substantive conclusions about the self from analyzing his or her own personal experiences. Adolescents may develop the ability to string together events into causal chains and inductively derive general themes about life from a sequence of chapters and scenes (**Habermas & de Silveira, 2008**). For example, a 16-year-old may be able to explain to herself and to others how childhood experiences in her family have shaped her vocation in life. Her parents were divorced when she was 5 years old, the teenager recalls, and this caused a great deal of stress in her family. Her mother often seemed anxious and depressed, but she (the now-teenager when she was a little girl—the story's protagonist) often tried to cheer her mother up, and her efforts seemed to work. In more recent years, the teenager notes that her friends often come to her with their boyfriend problems. She seems to be very adept at giving advice about love and relationships, which stems, the teenager now believes, from her early experiences with her mother. Carrying this causal narrative forward, the teenager now thinks that she would like to be a marriage counselor when she grows up.



Young people often “try on” many variations of identities to see which best fits their private sense of themselves. [Image: Sangudo, <https://goo.gl/Ay3UMR>, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

Unlike children, then, adolescents can tell a full and convincing story about an entire human life, or at least a prominent line of causation within a full life, explaining continuity and change in the story’s protagonist over time. Once the cognitive skills are in place, young people seek interpersonal opportunities to share and refine their developing sense of themselves as storytellers (the I) who tell stories about themselves (the Me).

Adolescents and young adults author a narrative sense of the self by telling stories about their experiences to other people, monitoring the feedback they receive from the tellings, editing their stories in light of the feedback, gaining new experiences and telling stories about those, and on and on, as selves create stories that, in turn, create new selves (McLean et al., 2007). Gradually, in fits and starts, through conversation and introspection, the I develops a convincing and coherent narrative about the Me.

Contemporary research on the **self as autobiographical author** emphasizes the strong effect of *culture* on narrative identity (Hammack, 2008). Culture provides a menu of favored plot lines, themes, and character types for the construction of self-defining life stories. Autobiographical authors sample selectively from the cultural menu, appropriating ideas that seem to resonate well with their own life experiences. As such, life stories reflect the culture, wherein they are situated as much as they reflect the authorial efforts of the autobiographical I.

As one example of the tight link between culture and narrative identity, McAdams (2013) and others (e.g., Kleinfeld, 2012) have highlighted the prominence of **redemptive narratives** in American culture. Epitomized in such iconic cultural ideals as the American dream, Horatio Alger stories, and narratives of Christian atonement, redemptive stories track the move from suffering to an enhanced status or state, while scripting the development of a chosen protagonist who journeys forth into a dangerous and unredeemed world (McAdams, 2013). Hollywood movies often celebrate redemptive quests. Americans are exposed to similar narrative messages in self-help books, 12-step programs, Sunday sermons, and in the rhetoric of political campaigns. Over the past two decades, the world's most influential spokesperson for the power of redemption in human lives may be Oprah Winfrey, who tells her own story of overcoming childhood adversity while encouraging others, through her media outlets and philanthropy, to tell similar kinds of stories for their own lives (McAdams, 2013). Research has demonstrated that American adults who enjoy high levels of mental health and civic engagement tend to construct their lives as narratives of redemption, tracking the move from sin to salvation, rags to riches, oppression to liberation, or sickness/abuse to health/recovery (McAdams, Diamond, de St. Aubin, & Mansfield, 1997; McAdams, Reynolds, Lewis, Patten, & Bowman, 2001; Walker & Frimer, 2007). In American society, these kinds of stories are often seen to be inspirational.

At the same time, McAdams (2011, 2013) has pointed to shortcomings and limitations in the redemptive stories that many Americans tell, which mirror cultural biases and stereotypes in American culture and heritage. McAdams has argued that redemptive stories support happiness and societal engagement for some Americans, but the same stories can encourage moral righteousness and a naïve expectation that suffering will always be redeemed. For better and sometimes

for worse, Americans seem to love stories of personal redemption and often aim to assimilate their autobiographical memories and aspirations to a redemptive form. Nonetheless, these same stories may not work so well in cultures that espouse different values and narrative ideals (**Hammack, 2008**). It is important to remember that every culture offers its own storehouse of favored narrative forms. It is also essential to know that no single narrative form captures all that is good (or bad) about a culture. In American society, the redemptive narrative is but one of many different kinds of stories that people commonly employ to make sense of their lives.

What is your story? What kind of a narrative are you working on? As you look to the past and imagine the future, what threads of continuity, change, and meaning do you discern? For many people, the most dramatic and fulfilling efforts to change the self happen when the I works hard, as an autobiographical author, to construct and, ultimately, to tell a new story about the Me. Storytelling may be the most powerful form of self-transformation that human beings have ever invented. Changing one's life story is at the heart of many forms of psychotherapy and counseling, as well as religious conversions, vocational epiphanies, and other dramatic transformations of the self that people often celebrate as turning points in their lives (**Adler, 2012**). Storytelling is often at the heart of the little changes, too, minor edits in the self that we make as we move through daily life, as we live and experience life, and as we later tell it to ourselves and to others.

Conclusion

For human beings, selves begin as social actors, but they eventually become motivated agents and autobiographical authors, too. The I first sees itself as an embodied actor in social space; with development, however, it comes to appreciate itself

also as a forward-looking source of self-determined goals and values, and later yet, as a storyteller of personal experience, oriented to the reconstructed past and the imagined future. To “know thyself” in mature adulthood, then, is to do three things: (a) to apprehend and to perform with social approval my self-ascribed traits and roles, (b) to pursue with vigor and (ideally) success my most valued goals and plans, and (c) to construct a story about life that conveys, with vividness and cultural resonance, how I became the person I am becoming, integrating my past as I remember it, my present as I am experiencing it, and my future as I hope it to be.

Check Your Knowledge

To help you with your studying, we’ve included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Autobiographical reasoning

The ability, typically developed in adolescence, to derive substantive conclusions about the self from analyzing one's own personal experiences.

Big Five

A broad taxonomy of personality trait domains repeatedly derived from studies of trait ratings in adulthood and encompassing the categories of (1) extraversion vs. introversion, (2) neuroticism vs. emotional stability, (3) agreeable vs. disagreeableness, (4) conscientiousness vs. nonconscientiousness, and (5) openness to experience vs. conventionality. By late childhood and early adolescence, people's self-attributions of personality traits, as well as the trait attributions made about them by others, show patterns of intercorrelations that confirm with the five-factor structure obtained in studies of adults.

Ego

Sigmund Freud's conception of an executive self in the personality. Akin to this module's notion of "the I," Freud imagined the ego as observing outside reality, engaging in rational thought, and coping with the competing demands of inner desires and moral standards.

Identity

Sometimes used synonymously with the term "self," identity means many different things in psychological science and in other fields (e.g., sociology). In this module, I adopt Erik Erikson's conception of identity as a developmental task for late adolescence and young adulthood. Forming an identity in adolescence and young adulthood involves exploring alternative roles, values, goals, and relationships and eventually committing to a realistic agenda for life that productively situates a person in the adult world of work and love. In addition, identity formation entails commitments to new social roles and reevaluation of old traits, and importantly, it brings with it a sense of temporal continuity in life, achieved through the construction of an integrative life story.

Narrative identity

An internalized and evolving story of the self designed to provide life with some measure of temporal unity and purpose. Beginning in late adolescence, people craft self-defining stories that reconstruct the past and imagine the future to explain how the person came to be the person that he or she is becoming.

Redemptive narratives

Life stories that affirm the transformation from suffering to an enhanced status or state. In American culture, redemptive life stories are highly prized as models for the good self, as in classic narratives of atonement, upward mobility, liberation, and recovery.

Reflexivity

The idea that the self reflects back upon itself; that the I (the knower, the subject) encounters the Me (the known, the object). Reflexivity is a fundamental property of human selfhood.

Self as autobiographical author

The sense of the self as a storyteller who reconstructs the past and imagines the future in order to articulate an integrative narrative that provides life with some measure of temporal continuity and purpose.

Self as motivated agent

The sense of the self as an intentional force that strives to achieve goals, plans, values, projects, and the like.

Self as social actor

The sense of the self as an embodied actor whose social performances may be construed in terms of more or less consistent self-ascribed traits and social roles.

Self-esteem

The extent to which a person feels that he or she is worthy and good. The success or failure that the motivated agent experiences in pursuit of valued goals is a strong determinant of self-esteem.

Social reputation

The traits and social roles that others attribute to an actor. Actors also have their own conceptions of what they imagine their respective social reputations indeed are in the eyes of others.

The Age 5-to-7 Shift

Cognitive and social changes that occur in the early elementary school years that result in the child's developing a more purposeful, planful, and goal-directed approach to life, setting the stage for the emergence of the self as a motivated agent.

The "I"

The self as knower, the sense of the self as a subject who encounters (knows, works on) itself (the Me).

The "Me"

The self as known, the sense of the self as the object or target of the I's knowledge and work.

Theory of mind

Emerging around the age of 4, the child's understanding that other people have minds in which are located desires and beliefs, and that desires and beliefs, thereby, motivate behavior.

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69. Relationships and Well-being

Original chapter by Kenneth Tan and Louis Tay
adapted by the Queen's University
Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

The relationships we cultivate in our lives are essential to our well-being—namely, happiness and health. Why is that so? We begin to answer this question by exploring the types of relationships—family, friends, colleagues, and lovers—we have in our lives and how they are measured. We also explore the different aspects of happiness and health, and show how the quantity and quality of relationships can affect our happiness and health.

Learning Objectives

- Understand why relationships are key to happiness and health.
- Define and list different forms of relationships.

- List different aspects of well-being.
- Explain how relationships can enhance well-being.
- Explain how relationships might not enhance well-being.

Introduction



One of the most basic human needs is the need to belong.
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In Daniel Defoe's classic novel *Robinson Crusoe* (1719), the main character is shipwrecked. For years he lives alone, creating a shelter for himself and marking the passage of time on a wooden calendar. It is a lonely existence, and Crusoe describes climbing a hilltop in the hopes of seeing a passing ship and possible rescue. He scans the horizon

until, in his own words, he is “almost blind.” Then, without hope, he sits and weeps.

Although it is a work of fiction, *Robinson Crusoe* contains themes we can all relate to. One of these is the idea of loneliness. Humans are social animals and we prefer living together in groups. We cluster in families, in cities, and in groups of friends. In fact, most people spend relatively few of their waking hours alone. Even introverts report feeling happier when they are with others! Yes, being surrounded by people and feeling connected to others appears to be a natural impulse.

In this module we will discuss relationships in the context of well-being. We will begin by defining well-being and then presenting research about different types of relationships. We will explore how both the quantity and quality of our

relationships affect us, as well as take a look at a few popular conceptions (or misconceptions) about relationships and happiness.

The Importance of Relationships

If you were to reflect on the best moments of your life, chances are they involved other people. We feel good sharing our experiences with others, and our desire for high quality relationships may be connected to a deep-seated psychological impulse: the need to belong (**Baumeister & Leary, 1995**). Aristotle commented that humans are fundamentally social in nature. Modern society is full of evidence that Aristotle was right. For instance, people often hold strong opinions about single child families—usually concerning what are often viewed as problematic “only child” characteristics—and most parents choose to have multiple kids. People join book clubs to make a solitary activity—reading—into a social activity. Prisons often punish offenders by putting them in solitary confinement, depriving them of the company of others. Perhaps the most obvious expression of the need to belong in contemporary life is the prevalence of social media. We live in an era when, for the first time in history, people effectively have two overlapping sets of social relationships: those in the real world and those in the virtual world.

It may seem intuitive that our strong urge to connect with others has to do with the boost we receive to our own well-being from relationships. After all, we derive considerable meaning from our relational bonds—as seen in the joy a newborn brings to its parents, the happiness of a wedding, and the good feelings of having reliable, supportive friendships. In fact, this intuition is borne out by research suggesting that relationships can be sources of intimacy and closeness (**Reis,**

Clark & Holmes, 2004), comfort and relief from stress (**Collins & Feeney, 2000**), and accountability—all of which help toward achieving better health outcomes (**Tay, Tan, Diener, & Gonzalez, 2013; Taylor, 2010**). Indeed, scholars have long considered social relationships to be fundamental to happiness and well-being (**Argyle, 2001; Myers, 2000**). If the people in our lives are as important to our happiness as the research suggests, it only makes sense to investigate how relationships affect us.

The Question of Measurement

Despite the intuitive appeal of the idea that good relationships translate to more happiness, researchers must collect and analyze data to arrive at reliable conclusions. This is particularly difficult with the concepts of relationships and happiness, because both can be difficult to define. What counts as a relationship? A pet? An old friend from childhood you haven't seen in ten years? Similarly, it is difficult to pinpoint exactly what qualifies as happiness. It is vital to define these terms, because their definitions serve as the guidelines by which they can be measured, a process called **operationalization**. Scientifically speaking, the two major questions any researcher needs to answer before he or she can begin to understand how relationships and well-being interact are, "How do I best measure relationships?" and "How do I best measure well-being?"

Let's begin with relationships. There are



Scientists are interested in objective measures such as the number of friends a person has and subjective measures such as feelings of social support. [Image: CC0 Public Domain, <https://goo.gl/m25gce>]

both *objective* and *subjective* ways to measure social relationships. **Objective social variables** are factors that are based on evidence rather than opinions. They focus on the *presence* and *frequency* of different types of relationships, and the *degree of contact* and *amount of shared activities* between people. Examples of these measures include participants' marital status, their number of friends and work colleagues, and the size of their social networks. Each of these variables is factually based (e.g., you have x number of coworkers, etc.). Another objective social variable is **social integration**, or one's degree of integration into social networks. This can be measured by looking at the frequency and amount of social activity or contact one has with others (see **Okun, Stock, Haring, & Witter, 1984; Pinquart & Sorensen, 2000**). The strength of objective measures is that they generally have a single correct answer. For example, a person is either married or not; there is no in-between.

Subjective social variables, as the name suggests, are those that focus on the subjective qualities of social relationships. These are the products of personal opinions and feelings rather

than facts. A key subjective variable is **social support**—the extent to which individuals feel cared for, can receive help from others, and are part of a supportive network. Measures of social support ask people to report on their perceived levels of support as well as their satisfaction with the support they receive (see **Cohen, Underwood, & Gottlieb, 2000**). Other subjective social variables assess the nature and quality of social relationships themselves—that is, what types of relationships people have, and whether these social relationships are good or bad. These can include measures that ask about the quality of a marriage (e.g., Dyadic Adjustment Scale; **Spanier, 1976**), the amount of conflict in a relationship (e.g., Conflict Tactics Scale; **Straus, 1979**), or the quality of each relationship in one's social network (e.g., Network of Relationships Inventory (NRI); **Furman & Buhrmester, 1985**). The strength of subjective measures is that they provide insight into people's personal experience. A married person, for example, might love or hate their marriage; subjective measures tell us which of these is the case.

Objective and subjective measures are often administered in a way that asks individuals to make a global assessment of their relationships (i.e., "How much social support do you receive?"). However, scientists have more recently begun to study social relationships and activity using methods such as daily diary methodology (**Bolger, Davis, & Rafaeli, 2003**), whereby individuals report on their relationships on a regular basis (e.g., three times a day). This allows researchers to examine in-the-moment instances and/or day-to-day trends of how social relationships affect happiness and well-being compared to more global measures. Many researchers try to include multiple types of measurement—objective, subjective, and daily diaries—to overcome the weaknesses associated with any one measurement technique.

Just as researchers must consider how to best measure relationships, they must also face the issue of measuring well-

being. Well-being is a topic many people have an opinion about. If you and nine other people were to write down your own definitions of happiness, or of well-being, there's a good chance you'd end up with ten unique answers. Some folks define happiness as a sense of peace, while others think of it as being healthy. Some people equate happiness with a sense of purpose, while others think of it as just another word for joy. Modern researchers have wrestled with this topic for decades. They acknowledge that both psychological and physical approaches are relevant to defining well-being, and that many dimensions—satisfaction, joy, meaning—are all important.

One prominent psychological dimension of well-being is happiness. In psychology, the scientific term for happiness is **subjective well-being**, which is defined by three different components: high *life satisfaction*, which refers to positive evaluations of one's life in general (e.g., "Overall, I am satisfied with my life"); *positive feelings*, which refers to the amount of positive emotions one experiences in life (e.g., peace, joy); and *low negative feelings*, which refers to the amount of negative emotions one experiences in life (e.g., sadness, anger) (**Diener, 1984**). These components are commonly measured using subjective self-report scales.

Below are five statements that you may agree or disagree with. Using the 1 - 7 scale below, indicate your agreement with each item by placing the appropriate number on the line preceding that item. Please be open and honest in your responding.

7 – Strongly agree

6 – Agree

5 – Slightly agree

4 – Neither agree nor disagree

3 – Slightly disagree

2 – Disagree

1 – Strongly disagree

_____ In most ways my life is close to my ideal.

_____ The conditions of my life are excellent.

_____ I am satisfied with my life.

_____ So far I have gotten the important things I want in life.

_____ If I could live my life over, I would change almost nothing.

Scoring:

31 - 35 **Extremely satisfied**

26 - 30 **Satisfied**

21 - 25 **Slightly satisfied**

20 **Neutral**

15 - 19 **Slightly dissatisfied**

10 - 14 **Dissatisfied**

5 - 9 **Extremely dissatisfied**

The Satisfaction with Life Scale is one of the most widely used measures of well-being in the world

The physical dimension of well-being is best thought of as one's **health**. Health is a broad concept and includes, at least in

part, being free of illness or infirmity. There are several aspects of physical health that researchers commonly consider when thinking about well-being and relationships. For example, health can be defined in terms of (A) injury, (B) disease, and (C) mortality. Health can also include physiological indicators, such as blood pressure or the strength of a person's immune system. Finally, there are **health behaviors** to be considered, such as dietary consumption, exercise, and smoking. Researchers often examine a variety of health variables in order to better understand the possible benefits of good relationships.

Presence and Quality of Relationships and Well-Being

If you wanted to investigate the connection between social relationships and well-being, where would you start? Would you focus on teenagers? Married couples? Would you interview religious people who have taken a vow of silence? These are the types of considerations well-being researchers face. It is impossible for a single study to look at all types of relationships across all age groups and cultures. Instead, researchers narrow their focus to specific variables. They tend to consider two major elements: the presence of relationships, and the quality of relationships.

Presence of relationships

The first consideration when trying to understand how relationships influence well-being is the presence of relationships. Simply put, researchers need to know whether or not people have relationships. Are they married? Do they have many friends? Are they a member of a club? Finding this out

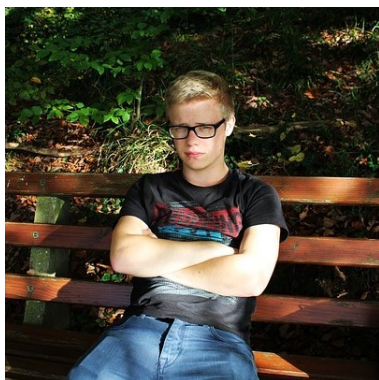
can be accomplished by looking at objective social variables, such as the size of a person's social network, or the number of friends they have. Researchers have discovered that the more social relationships people have, in general, the more positively their sense of well-being is impacted (**Lucas, Dyrenforth, & Diener 2008**). In one study of more than 200 undergraduate students, psychologists Ed Diener and Martin Seligman (**Diener & Seligman, 2002**) compared the happiest 10% to the unhappiest 10%. The researchers were curious to see what differentiated these two groups. Was it gender? Exercise habits? Religion? The answer turned out to be relationships! The happiest students were much more satisfied with their relationships, including with close friends, family, and romantic partnerships, than the unhappiest. They also spent less time alone.

Some people might be inclined to dismiss the research findings above because they focused primarily on college students. However, in a worldwide study of people of all ages from 123 nations, results showed that having even a few high quality social relationships was consistently linked with subjective well-being (**Tay & Diener, 2011**). This is an important finding because it means that a person doesn't have to be a social butterfly in order to be happy. Happiness doesn't depend necessarily on having dozens of friends, but rather on having at least a few close connections.

Another way of gaining an understanding of the presence of relationships is by looking at the *absence* of relationships. A lack of social connections can lead to loneliness and depression. People lose well-being when social relationships are denied—as in cases of **ostracism**. In many societies, withholding social relationships is used as a form of punishment. For example, in some Western high schools, people form social groups known as “cliques,” in which people share interests and a sense of identity. Unlike clubs, cliques do not have explicit rules for membership but tend to form

organically, as exclusive group friendships. When one member of a clique conflicts with the others, the offending member may be socially rejected.

Similarly, some small societies practice **shunning**, a temporary period during which members withhold emotion, communication, and other forms of social contact as a form of punishment for wrongdoing. The Amish—a group of traditional Christian communities in North America who reject modern conveniences such as electricity—occasionally practice shunning (**Hostetler,**



Ostracism is a form of social rejection and isolation that has a negative impact on well-being.

[Image: CC0 Public Domain, <https://goo.gl/m25gce>]

1993). Members who break important social rules, for example, are made to eat alone rather than with their family. This typically lasts for one to two weeks. Individuals' well-being has been shown to dramatically suffer when they are ostracized in such a way (**Williams, 2009**). Research has even shown that the areas of the brain that process physical pain when we are injured are the same areas that process emotional pain when we are ostracized (**Eisenberger, Lieberman, & Williams, 2003**).

Quality of relationships

Simply having a relationship is not, in itself, sufficient to produce well-being. We're all familiar with instances of awful relationships: Cinderella and her step-sisters, loveless marriages, friends who have frequent falling-outs (giving birth to the word "frenemy"). In order for a relationship to improve

well-being it has to be a good one. Researchers have found that higher friendship quality is associated with increased happiness (**Demir & Weitekamp, 2007**). Friendships aren't the only relationships that help, though. Researchers have found that high quality relationships between parents and children are associated with increased happiness, both for teenagers (**Gohm, Oishi, Darlington, & Diener, 1998**) and adults (**Amato & Afifi, 2006**).

Finally, an argument can be made for looking at relationships' effects on each of the distinct components of subjective well-being. Walen and Luchman (**2000**) investigated a mix of relationships, including family, friends, and romantic partners. They found that social support and conflict were associated with all three aspects of subjective well-being (life satisfaction, positive affect, and negative affect). Similarly, in a cross-cultural study comparing college students in Iran, Jordan, and the United States, researchers found that social support was linked to higher life satisfaction, higher positive affect, and lower negative affect (**Brannan, Biswas-Diener, Mohr, Mortazavi, & Stein, 2012**).

It may seem like common sense that good relationships translate to more happiness. You may be surprised to learn, however, that good relationships also translate to better health. Interestingly, both the *quality* and *quantity* of social relationships can affect a person's health (**Cohen 1988; House, Landis, & Umberson, 1988**). Research has shown that having a larger social network and high quality relationships can be beneficial for health, whereas having a small social network and poor quality relationships can actually be *detrimental* to health (**Uchino, 2006**). Why might it be the case that good relationships are linked to health? One reason is that friends and romantic partners might share health behaviors, such as wearing seat belts, exercising, or abstaining from heavy alcohol consumption. Another reason is that people who experience

social support might feel less stress. Stress, it turns out, is associated with a variety of health problems.

Types of Relationships

Intimate relationships

It makes sense to consider the various types of relationships in our lives when trying to determine just how relationships impact our well-being. For example, would you expect a person to derive the exact same happiness from an ex-spouse as from a child or coworker? Among the most important relationships for most people is their long-time romantic partner. Most researchers begin their investigation of this topic by focusing on intimate relationships because they are the closest form of social bond. Intimacy is more than just physical in nature; it also entails psychological closeness. Research findings suggest that having a single **confidante**—a person with whom you can be authentic and trust not to exploit your secrets and vulnerabilities—is more important to happiness than having a large social network (see **Taylor, 2010** for a review).

Another important aspect of relationships is the distinction between formal and informal. Formal relationships are those that are bound by the rules of politeness. In most cultures, for instance, young people treat older people with formal respect, avoiding profanity and slang when interacting with them. Similarly, workplace relationships tend to be more formal, as do relationships with new acquaintances. Formal connections are generally less relaxed because they require a bit more work, demanding that we exert more self-control. Contrast these connections with informal relationships—friends, lovers, siblings, or others with whom you can relax. We can express our true feelings and opinions in these informal relationships,

using the language that comes most naturally to us, and generally being more authentic. Because of this, it makes sense that more intimate relationships—those that are more comfortable and in which you can be more vulnerable—might be the most likely to translate to happiness.

The most common way researchers investigate intimacy is by examining marital status. Although marriage is just one type of intimate relationship, it is by far the most common type. In some research, the well-being of married people is compared to that of people who are single or have never been married, and in other research, married people are compared to people who are divorced or widowed (**Lucas & Dyrenforth, 2005**). Researchers have found that the transition from singlehood to marriage brings about an increase in subjective well-being (**Haring-Hidore, Stock, Okun, & Witter, 1985; Lucas, 2005; Williams, 2003**). Research has also shown that progress through the stages of relationship commitment (i.e., from singlehood to dating to marriage) is also associated with an increase in happiness (**Dush & Amato, 2005**). On the other hand, experiencing divorce, or the death of a spouse, leads to adverse effects on subjective well-being and happiness, and these effects are stronger than the positive effects of being married (**Lucas, 2005**).

Although research frequently points to marriage being associated with higher rates of happiness, this does not guarantee that getting married will make you happy! The quality of one's marriage matters greatly. When a person remains in a problematic marriage, it takes an emotional toll. Indeed, a large body of research shows that people's overall life satisfaction is affected by their satisfaction with their marriage (**Carr, Freedman, Cornman, Schwarz, 2014; Dush, Taylor, & Kroeger, 2008; Karney, 2001; Luhmann, Hofmann, Eid, & Lucas, 2012; Proulx, Helms, & Buehler, 2007**). The lower a person's self-reported level of marital quality, the more likely he or she is to report depression (**Bookwala, 2012**). In fact,

longitudinal studies—those that follow the same people over a period of time—show that as marital quality declines, depressive symptoms increase (**Fincham, Beach, Harold, & Osborne, 1997; Karney, 2001**). Proulx and colleagues (**2007**) arrived at this same conclusion after a systematic review of 66 cross-sectional and 27 longitudinal studies.

What is it about bad marriages, or bad relationships in general, that takes such a toll on well-being? Research has pointed to conflict between partners as a major factor leading to lower subjective well-being (**Gere & Schimmack, 2011**). This makes sense. Negative relationships are linked to ineffective social support (**Reblin, Uchino, & Smith, 2010**) and are a source of stress (**Holt-Lunstad, Uchino, Smith, & Hicks, 2007**). In more extreme cases, physical and psychological abuse can be detrimental to well-being (**Follingstad, Rutledge, Berg, Hause, & Polek, 1990**). Victims of abuse sometimes feel shame, lose their sense of self, and become less happy and prone to depression and anxiety (**Arias & Pape, 1999**). However, the unhappiness and dissatisfaction that occur in abusive relationships tend to dissipate once the relationships end. (**Arriaga, Capezza, Goodfriend, Rayl & Sands, 2013**).

Work Relationships and Well-Being

Working adults spend a large part of their waking hours in relationships with coworkers and supervisors. Because these relationships are forced upon us by work, researchers focus less on their presence or absence and instead focus on their quality. High quality work relationships can make jobs enjoyable and less stressful. This is because workers experience mutual trust and support in the workplace to overcome work challenges.



Since we spend so much of our time at work it's essential to our well-being that we get along with our coworkers! [Image: Editor B, <https://goo.gl/pnc4G6>, CC BY 2.0, <https://goo.gl/BRvSA7>]

Liking the people we work with can also translate to more humor and fun on the job. Research has shown that supervisors who are more supportive have employees who are more likely to thrive at work (Paterson, Luthans, & Jeung, **2014**; **Monnot & Beehr, 2014**; **Winkler, Busch, Clasen, & Vowinkel, 2015**). On the other hand, poor quality work relationships can make a job feel like drudgery. Everyone knows that horrible bosses can make the workday unpleasant. Supervisors that are sources of stress have a negative impact on the subjective well-being of their employees (**Monnot & Beehr, 2014**). Specifically, research has shown that employees who rate their supervisors high on the so-called “dark triad”—**psychopathy, narcissism, and Machiavellianism**—reported greater psychological distress at work, as well as less job satisfaction (**Mathieu, Neumann, Hare, & Babiak, 2014**).

In addition to the direct benefits or costs of work relationships on our well-being, we should also consider how

these relationships can impact our job performance. Research has shown that feeling engaged in our work and having a high job performance predicts better health and greater life satisfaction (**Shimazu, Schaufeli, Kamiyama, & Kawakami, 2015**). Given that so many of our waking hours are spent on the job—about ninety thousand hours across a lifetime—it makes sense that we should seek out and invest in positive relationships at work.

Fact or Myth: Are Social Relationships the Secret to Happiness?

If you read pop culture magazines or blogs, you've likely come across many supposed "secrets" to happiness. Some articles point to exercise as a sure route to happiness, while others point to gratitude as a crucial piece of the puzzle. Perhaps the most written about "secret" to happiness is having high quality social relationships. Some researchers argue that social relationships are central to subjective well-being (**Argyle, 2001**), but others contend that social relationships' effects on happiness have been exaggerated. This is because, when looking at the **correlations**—the size of the associations—between social relationships and well-being, they are typically small (**Lucas & Dyrenforth, 2006; Lucas et al., 2008**). Does this mean that social relationships are not actually important for well-being? It would be premature to draw such conclusions, because even though the effects are small, they are robust and reliable across different studies, as well as other domains of well-being. There may be no single secret to happiness but there may be a recipe, and, if so, good social relationships would be one ingredient.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Confidante

A trusted person with whom secrets and vulnerabilities can be shared.

Correlation

A measure of the association between two variables, or how they go together.

Health

The complete state of physical, mental, and social well-being—not just the absence of disease or infirmity.

Health behaviors

Behaviors that are associated with better health. Examples include exercising, not smoking, and wearing a seat belt while in a vehicle.

Machiavellianism

Being cunning, strategic, or exploitative in one's relationships. Named after Machiavelli, who outlined this way of relating in his book, *The Prince*.

Narcissism

A pervasive pattern of grandiosity (in fantasy or behavior), a need for admiration, and lack of empathy.

Objective social variables

Targets of research interest that are factual and not subject to personal opinions or feelings.

Operationalization

The process of defining a concept so that it can be measured. In psychology, this often happens by identifying related concepts or behaviors that can be more easily measured.

Ostracism

Being excluded and ignored by others.

Psychopathy

A pattern of antisocial behavior characterized by an inability to empathize, egocentricity, and a desire to use

relationships as tools for personal gain.

Shunning

The act of avoiding or ignoring a person, and withholding all social interaction for a period of time. Shunning generally occurs as a punishment and is temporary.

Social integration

Active engagement and participation in a broad range of social relationships.

Social support

A social network's provision of psychological and material resources that benefit an individual.

Subjective social variables

Targets of research interest that are not necessarily factual but are related to personal opinions or feelings

Subjective well-being

The scientific term used to describe how people experience the quality of their lives in terms of life satisfaction and emotional judgments of positive and negative affect.

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70. Culture

Original chapter by Robert Biswas-Diener
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This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen's Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

Although the most visible elements of culture are dress, cuisine and architecture, culture is a highly psychological phenomenon. Culture is a pattern of meaning for understanding how the world works. This knowledge is shared among a group of people and passed from one generation to the next. This module defines culture, addresses methodological issues, and introduces the idea that culture is a process. Understanding cultural processes can help people get along better with others and be more socially responsible.

Learning Objectives

- Appreciate culture as an evolutionary adaptation common to all humans.
- Understand cultural processes as variable patterns rather than as fixed scripts.

- Understand research methods when studying culture in psychological science.
- Appreciate cultural awareness as a source of personal well-being, social responsibility, and social harmony.
- Explain the difference between individualism and collectivism.
- Define “self-construal” and provide a real life example.

Introduction

When you think about different cultures, you likely picture their most visible features, such as differences in the way people dress, or in the architectural styles of their buildings. You might consider different types of food, or how people in some cultures eat with chopsticks while people in others use forks. There are differences in body language, religious practices, and wedding rituals. While these are all obvious examples of cultural differences, many distinctions are harder to see because they are psychological in nature.



Culture goes beyond the way people dress and the food they eat. It also stipulates morality, identity, and social roles. [Image: Faizal Riza MOHD RAF, <https://goo.gl/G7cbZh>, CC BY-NC 2.0, <https://goo.gl/VnKlK8>]

Just as culture can be seen in dress and food, it can also be seen in morality, identity, and gender roles. People from around the world differ in their views of premarital sex, religious tolerance, respect for elders, and even the importance they place on having fun. Similarly, many behaviors that may seem innate are actually products of culture. Approaches to punishment, for example, often depend on cultural norms for their effectiveness.

In the United States, people who ride public transportation without buying a ticket face the possibility of being fined. By contrast, in some other societies, people caught dodging the fare are socially shamed by having their photos posted publicly. The reason this campaign of “name and shame” might work in one society but not in another is that members of different cultures differ in how comfortable they are with being singled out for attention. This strategy is less effective for people who are not as sensitive to the threat of public shaming.

The psychological aspects of culture are often overlooked because they are often invisible. The way that gender roles are learned is a cultural process as is the way that people think about their own sense of duty toward their family members. In this module, you will be introduced to one of the most fascinating aspects of social psychology: the study of cultural processes. You will learn about research methods for studying culture, basic definitions related to this topic, and about the ways that culture affects a person’s sense of self.

Social Psychology Research Methods

Social psychologists are interested in the ways that cultural forces influence psychological processes. They study culture as a means of better understanding the ways it affects our emotions, identity, relationships, and decisions. Social psychologists generally ask different types of questions and use different methods than do anthropologists. Anthropologists are more likely to conduct **ethnographic studies**. In this type of research, the scientist spends time observing a culture and conducting interviews. In this way, anthropologists often attempt to understand and appreciate culture from the point of view of the people within it. Social psychologists who adopt this approach are often thought to be studying **cultural psychology**. They are likely to use interviews as a primary research methodology.

For example, in **a 2004 study** Hazel Markus and her colleagues wanted to explore class culture as it relates to well-being. The researchers adopted a cultural psychology approach and interviewed participants to discover—in the participants own words—what “the good life” is for Americans of different social classes. Dozens of participants answered 30 **open ended questions** about well-being during recorded, face-to-face interviews. After the interview data were collected the researchers then read the transcripts. From these, they agreed on common themes that appeared important to the participants. These included, among others, “health,” “family,” “enjoyment,” and “financial security.”

The Markus team discovered that people with a Bachelor’s Degree were more likely than high school educated participants to mention “enjoyment” as a central part of the good life. By contrast, those with a high school education were more likely to mention “financial security” and “having basic needs met.” There were similarities as well: participants from both groups placed a heavy emphasis on relationships with

others. Their understanding of *how* these relationships are tied to well-being differed, however. The college educated—especially men—were more likely to list “advising and respecting” as crucial aspects of relationships while their high school educated counterparts were more likely to list “loving and caring” as important. As you can see, cultural psychological approaches place an emphasis on the participants’ own definitions, language, and understanding of their own lives. In addition, the researchers were able to make comparisons between the groups, but these comparisons were based on loose themes created by the researchers.

Interestingly, researchers—and the rest of us!—have as much to learn from **cultural similarities** as **cultural differences**, and both require comparisons across cultures. For example, Diener and Oishi (2000) were interested in exploring the relationship between money and happiness. They were specifically interested in cross-cultural differences in levels of life satisfaction between people from different cultures. To examine this question they used international surveys that asked all participants the exact same question, such as “All things considered, how satisfied are you with your life as a whole these days?” and used a **standard scale** for answers; in this case one that asked people to use a 1-10 scale to respond. They also collected data on average income levels in each nation, and adjusted these for local differences in how many goods and services that money can buy.

The Diener research team discovered that, across more than 40 nations there was a tendency for money to be associated with higher life satisfaction. People from richer countries such as Denmark, Switzerland and Canada had relatively high satisfaction while their counterparts from poorer countries such as India and Belarus had lower levels. There were some interesting exceptions, however. People from Japan—a wealthy nation—reported lower satisfaction than did their peers in nations with similar wealth. In addition, people from

Brazil—a poorer nation—had unusually high scores compared to their income counterparts.

One problem with cross-cultural studies is that they are vulnerable to **ethnocentric bias**. This means that the researcher who designs the study might be influenced by personal biases that could affect research outcomes—without even being aware of it. For example, a study on happiness across cultures might investigate the ways that personal freedom is associated with feeling a sense of purpose in life. The researcher might assume that when people are free to choose their own work and leisure, they are more likely to pick options they care deeply about. Unfortunately, this researcher might overlook the fact that in much of the world it is considered important to sacrifice some personal freedom in order to fulfill one's duty to the group (**Triandis, 1995**). Because of the danger of this type of bias, social psychologists must continue to improve their methodology.

What is Culture?

Defining Culture

Like the words “happiness” and “intelligence,” the word “culture” can be tricky to define. **Culture** is a word that suggests *social patterns of shared meaning*. In essence, it is a collective understanding of the way the world works, shared by members of a group and passed down from one generation to the next. For example, members of the Yanomamö tribe, in South America, share a cultural understanding of the world that includes the idea that there are four parallel levels to reality that include an abandoned level, and earthly level and heavenly and hell-like levels. Similarly, members of surfing culture understand their athletic pastime as being worthwhile

and governed by formal rules of etiquette known only to insiders. There are several features of culture that are central to understanding the uniqueness and diversity of the human mind:

1. *Versatility*: Culture can change and adapt. Someone from the state of Orissa, in India, for example, may have multiple identities. She might see herself as Oriya when at home and speaking her native language. At other times, such as during the national cricket match against Pakistan, she might consider herself Indian. This is known as **situational identity**.
2. *Sharing*: Culture is the product of people sharing with one another. Humans cooperate and share knowledge and skills with other members of their networks. The ways they share, and the content of what they share, helps make up culture. Older adults, for instance, remember a time when long-distance friendships were maintained through letters that arrived in the mail every few months. Contemporary youth culture accomplishes the same goal through the use of instant text messages on smart phones.
3. *Accumulation*: Cultural knowledge is cumulative. That is, information is “stored.” This means that a culture’s collective learning grows across generations. We understand more about the world today than we did 200 years ago, but that doesn’t mean the culture from long ago has been erased by the new. For instance, members of the Haida culture—a First Nations people in British Columbia, Canada—profit from both ancient and modern experiences. They might employ traditional fishing practices and wisdom stories while also using modern technologies and services.
4. *Patterns*: There are systematic and predictable ways of behavior or thinking across members of a culture. Patterns

emerge from adapting, sharing, and storing cultural information. Patterns can be both similar and different across cultures. For example, in both Canada and India it is considered polite to bring a small gift to a host's home. In Canada, it is more common to bring a bottle of wine and for the gift to be opened right away. In India, by contrast, it is more common to bring sweets, and often the gift is set aside to be opened later.

Understanding the changing nature of culture is the first step toward appreciating how it helps people. The concept of **cultural intelligence** is the ability to understand why members of other cultures act in the ways they do. Rather than dismissing foreign behaviors as weird, inferior, or immoral, people high in cultural intelligence can appreciate differences even if they do not necessarily share another culture's views or adopt its ways of doing things.

Thinking about Culture

One of the biggest problems with understanding culture is that the word itself is used in different ways by different people. When someone says, "My company has a competitive culture," does it mean the same thing as when another person says, "I'm taking my children to the museum so they can get some culture"? The truth is, there are many ways to think about culture. Here are three ways to parse this concept:

1. *Progressive cultivation*: This refers to a relatively small subset of activities that are intentional and aimed at "being refined." Examples include learning to play a musical instrument, appreciating visual art, and attending theater performances, as well as other instances of so-called "high art." This was the predominant use of the

word culture through the mid-19th century. This notion of culture formed the basis, in part, of a superior mindset on the behalf of people from the upper economic classes. For instance, many tribal groups were seen as lacking cultural sophistication under this definition. In the late 19th century, as global travel began to rise, this understanding of culture was largely replaced with an understanding of it as a way of life.

2. *Ways of Life*: This refers to distinct patterns of beliefs and behaviors widely shared among members of a culture. The “ways of life” understanding of culture shifts the emphasis to patterns of belief and behavior that persist over many generations. Although cultures can be small—such as “school culture”—they usually describe larger populations, such as nations. People occasionally confuse national identity with culture. There are similarities in culture between Japan, China, and Korea, for example, even though politically they are very different. Indeed, each of these nations also contains a great deal of cultural variation within themselves.
3. *Shared Learning*: In the 20th century, anthropologists and social psychologists developed the concept of **enculturation** to refer to the ways people learn about and shared cultural knowledge. Where “ways of life” is treated as a noun “enculturation” is a verb. That is, enculturation is a fluid and dynamic process. That is, it emphasizes that culture is a process that can be learned. As children are raised in a society, they are taught how to behave according to regional cultural norms. As immigrants settle in a new country, they learn a new set of rules for behaving and interacting. In this way, it is possible for a person to have multiple **cultural scripts**.

Culture Concept	Examples	Social Impact	Highlighted Themes
Progressive Cultivation	<ul style="list-style-type: none">• College education• Advanced technology• Ballet• Formal etiquette	A distinction between elites and the masses, between “higher civilizations” and “barbarians,” between old and young, or between men and women	Deliberate pursuit of mental refinement; efforts to create and improve abilities that seem to offer better prospects of wellbeing, power, or dignity
Way of Life	<ul style="list-style-type: none">• National traditions• Religious doctrines• Organizational culture	Geographical or ethnic distinctions between large and spatially segregated populations	Similar beliefs and values within populations, but differences between them; strong cultural identity and stereotyping of out-group members; stability of culture over time
Shared Learning and Enculturation	<ul style="list-style-type: none">• Parenting• Teaching• Apprenticeship• Information-sharing and influencing through social networks	Emphasis on the developmental potential of everyone and on the different ways in which individuals develop, depending on different forms of enculturation	An understanding of diversity within populations, individual exposure to multiple cultural influences, negotiation and debating about cultural values and identities.

Table 2: Culture concepts and their application

The understanding of culture as a learned pattern of views and behaviors is interesting for several reasons. First, it highlights the ways groups can come into conflict with one another. Members of different cultures simply learn different ways of behaving. Modern youth culture, for instance, interacts with technologies such as smart phones using a different set of rules than people who are in their 40s, 50s, or 60s. Older adults might find texting in the middle of a face-to-face conversation rude while younger people often do not. These differences can sometimes become politicized and a source of tension between groups. One example of this is Muslim women who wear a *hijab*, or head scarf. Non-Muslims do not follow this practice, so occasional misunderstandings arise about the appropriateness of the tradition. Second, understanding that culture is learned is important because it means that people can adopt an appreciation of patterns of behavior that are different than their own. For example, non-Muslims might find it helpful to learn about the hijab. Where did this tradition come from? What does it mean and what are various Muslim opinions about wearing one? Finally, understanding that culture is learned can be helpful in developing self-awareness.

For instance, people from the United States might not even be aware of the fact that their attitudes about public nudity are influenced by their cultural learning. While women often go topless on beaches in Europe and women living a traditional tribal existence in places like the South Pacific also go topless, it is illegal for women in some of the United States to do so. These cultural norms for modesty—reflected in government laws and policies—also enter the discourse on social issues such as the appropriateness of breast-feeding in public. Understanding that your preferences are—in many cases—the products of cultural learning might empower you to revise them if doing so will lead to a better life for you or others.

The Self and Culture

Traditionally, social psychologists have thought about how patterns of behavior have an overarching effect on populations' attitudes. Harry Triandis, a cross-cultural psychologist, has studied culture in terms of individualism and collectivism. Triandis became interested in culture because of his unique upbringing. Born in Greece, he was raised under both the German and Italian occupations during World War II. The Italian soldiers broadcast classical music in the town square and built a swimming pool for the townspeople. Interacting



In a world that is increasingly connected by travel, technology, and business the ability to understand and appreciate the differences between cultures is more important than ever.

Psychologists call this capability "cultural intelligence". [Image: <https://goo.gl/SkXR07>, CC0 Public Domain, <https://goo.gl/m25gce>]

with these foreigners—even though they were an occupying army—sparked Triandis’ curiosity about other cultures. He realized that he would have to learn English if he wanted to pursue academic study outside of Greece and so he practiced with the only local who knew the language: a mentally ill 70 year old who was incarcerated for life at the local hospital. He went on to spend decades studying the ways people in different cultures define themselves (Triandis, 2008).

So, what exactly were these two patterns of culture Triandis focused on: **individualism** and **collectivism**? Individualists, such as most people born and raised in Australia or the United States, define themselves as individuals. They seek personal freedom and prefer to voice their own opinions and make their own decisions. By contrast, collectivists—such as most people born and raised in Korea or in Taiwan— are more likely to emphasize their connectedness to others. They are more likely to sacrifice their personal preferences if those preferences come in conflict with the preferences of the larger group (Triandis, 1995).

Both individualism and collectivism can further be divided into *vertical* and *horizontal* dimensions (Triandis, 1995). Essentially, these dimensions describe social status among members of a society. People in vertical societies differ in status, with some people being more highly respected or having more privileges, while in horizontal societies people are relatively equal in status and privileges. These dimensions are, of course, simplifications.

Neither individualism nor collectivism is the “correct way to live.” Rather, they are two separate patterns with slightly different emphases. People from individualistic societies often have more social freedoms, while collectivistic societies often have better social safety nets.

	Individualist	Collectivist
Vertical	People are unique; some distinguish themselves and enjoy higher status. Example: United States	People emphasize their connectedness and must do their duty; some enjoy higher status. Example: Japan
Horizontal	People are unique; most people have the same status. Example: Denmark	People emphasize their connectedness and work toward common goals; most people have the same status. Example: Israeli kibbutz

Table 3: Individualist and collectivist cultures

There are yet other ways of thinking about culture, as well. The cultural patterns of individualism and collectivism are linked to an important psychological phenomenon: the way that people understand themselves. Known as **self-construal**, this is the way people define the way they “fit” in relation to others. Individualists are more likely to define themselves in terms of an **independent self**. This means that people see themselves as A) being a unique individual with a stable collection of personal traits, and B) that these traits drive behavior. By contrast, people from collectivist cultures are more likely to identify with the **interdependent self**. This means that people see themselves as A) defined differently in each new social context and B) social context, rather than internal traits, are the primary drivers of behavior (Markus & Kitayama, 1991).

What do the independent and interdependent self look like in daily life? One simple example can be seen in the way that people describe themselves. Imagine you had to complete the sentence starting with “I am.....”. And imagine that you had to do this 10 times. People with an independent sense of self are more likely to describe themselves in terms of traits such as “I am honest,” “I am intelligent,” or “I am talkative.” On the other

hand, people with a more interdependent sense of self are more likely to describe themselves in terms of their relation to others such as “I am a sister,” “I am a good friend,” or “I am a leader on my team” (Markus, 1977).

The psychological consequences of having an independent or interdependent self can also appear in more surprising ways. Take, for example, the emotion of anger. In Western cultures, where people are more likely to have an independent self, anger arises when people’s personal wants, needs, or values are attacked or frustrated (Markus & Kitayama, 1994). Angry Westerners sometimes complain that they have been “treated unfairly.” Simply put, anger—in the Western sense—is the result of violations of the self. By contrast, people from interdependent self cultures, such as Japan, are likely to experience anger somewhat differently. They are more likely to feel that anger is unpleasant not because of some personal insult but because anger represents a lack of harmony between people. In this instance, anger is particularly unpleasant when it interferes with close relationships.

Culture is Learned

It’s important to understand that culture is learned. People aren’t born using chopsticks or being good at soccer simply because they have a genetic predisposition for it. They learn to excel at these activities because they are born in countries like Argentina, where playing soccer is an important part of daily life, or in areas like Taiwan, where chopsticks are the primary eating utensils. So, how are such cultural behaviors learned? It turns out that cultural skills and knowledge are learned in much the same way a person might learn to do algebra or knit. They are acquired through a combination of explicit teaching and implicit learning—by observing and copying.

Cultural teaching can take many forms. It begins with

parents and caregivers, because they are the primary influence on young children. Caregivers teach kids, both directly and by example, about how to behave and how the world works. They encourage children to be polite, reminding them, for instance, to say “Thankyou.” They teach kids how to dress in a way that is appropriate for the culture. They introduce children to religious beliefs and the rituals that go with them. They even teach children how to think and feel! Adult men, for example, often exhibit a certain set of emotional expressions—such as being tough and not crying—that provides a model of masculinity for their children. This is why we see different ways of expressing the same emotions in different parts of the world.



Culture teaches us what behaviors and emotions are appropriate or expected in different situations.
[Image: Portal de Copa,
<https://goo.gl/iEoW6X>, CC BY 3.0,
<https://goo.gl/b58TcB>]

In some societies, it is considered appropriate to conceal anger. Instead of expressing their feelings outright, people purse their lips, furrow their brows, and say little. In other cultures, however, it is appropriate to express anger. In these places, people are more likely to bare their teeth, furrow their brows, point or gesture, and yell (Matsumoto, Yoo, &

Chung, 2010). Such patterns of behavior are learned. Often, adults are not even aware that they are, in essence, teaching psychology—because the lessons are happening through **observational learning**.

Let's consider a single example of a way you behave that is learned, which might surprise you. All people gesture when they speak. We use our hands in fluid or choppy motions—to point things out, or to pantomime actions in stories. Consider how you might throw your hands up and exclaim, “I have no idea!” or how you might motion to a friend that it's time to go.

Even people who are born blind use hand gestures when they speak, so to some degree this is a *universal behavior*, meaning all people naturally do it. However, social researchers have discovered that culture influences how a person gestures. Italians, for example, live in a society full of gestures. In fact, they use about 250 of them (**Poggi, 2002**)! Some are easy to understand, such as a hand against the belly, indicating hunger. Others, however, are more difficult. For example, pinching the thumb and index finger together and drawing a line backwards at face level means “perfect,” while knocking a fist on the side of one’s head means “stubborn.”

Beyond observational learning, cultures also use **rituals** to teach people what is important. For example, young people who are interested in becoming Buddhist monks often have to endure rituals that help them shed feelings of specialness or superiority—feelings that run counter to Buddhist doctrine. To do this, they might be required to wash their teacher’s feet, scrub toilets, or perform other menial tasks. Similarly, many Jewish adolescents go through the process of *bar* and *bat mitzvah*. This is a ceremonial reading from scripture that requires the study of Hebrew and, when completed, signals that the youth is ready for full participation in public worship.

Cultural Relativism

When social psychologists research culture, they try to avoid making value judgments. This is known as **value-free research** and is considered an important approach to scientific objectivity. But, while such objectivity is the goal, it is a difficult one to achieve. With this in mind, anthropologists have tried to adopt a sense of empathy for the cultures they study. This has led to **cultural relativism**, the principle of regarding and valuing the practices of a culture from the point of view of that culture. It is a considerate and practical way to avoid hasty

judgments. Take for example, the common practice of same-sex friends in India walking in public while holding hands: this is a common behavior and a sign of connectedness between two people. In England, by contrast, holding hands is largely limited to romantically involved couples, and often suggests a sexual relationship. These are simply two different ways of understanding the meaning of holding hands. Someone who does not take a *relativistic* view might be tempted to see their own understanding of this behavior as superior and, perhaps, the foreign practice as being immoral.

Despite the fact that cultural relativism promotes the appreciation for cultural differences, it can also be problematic. At its most extreme it leaves no room for criticism of other cultures, even if certain cultural practices are horrific or harmful. Many practices have drawn criticism over the years. In Madagascar, for example, the *famahidana* funeral tradition includes bringing bodies out from tombs once every seven years, wrapping them in cloth, and dancing with them. Some people view this practice as disrespectful to the body of a deceased person. Another example can be seen in the historical Indian practice of *sati*—the burning to death of widows on their deceased husband's funeral pyre. This practice was outlawed by the British when they colonized India. Today, a debate rages about the ritual cutting of genitals of children in several Middle Eastern and African cultures. To a lesser extent, this same debate arises around the circumcision of baby boys in Western hospitals. When considering harmful cultural traditions, it can be patronizing to the point of racism to use cultural relativism as an excuse for avoiding debate. To assume that people from other cultures are neither mature enough nor responsible enough to consider criticism from the outside is demeaning.



In some cultures, it's perfectly normal for same-sex friends to hold hands while in others, handholding is restricted to romantically involved individuals only. [Image: Subharnab Majumdar, <http://goo.gl/0Ghf0f>, CC BY-2.0, <http://goo.gl/T4qgSp>]

Positive cultural relativism is the belief that the world would be a better place if everyone practiced some form of intercultural empathy and respect. This approach offers a potentially important contribution to theories of cultural progress: to better understand human behavior, people should avoid adopting extreme views that block discussions about the basic morality or usefulness of cultural practices.

Studying Culture with Psychological Science at Queen's

Dr. Li-Jun Ji is a psychological scientist at Queen's who studies the role of culture in the field of social psychology. In this video,

Dr. Ji highlights just some of the many ways in which culture affects our every day life.



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here:

<https://ecampusontario.pressbooks.pub/testbookje/?p=3196#h5p-5>

Conclusion

We live in a unique moment in history. We are experiencing the rise of a global culture in which people are connected and able to exchange ideas and information better than ever before. International travel and business are on the rise. Instantaneous communication and social media are creating networks of contacts who would never otherwise have had a chance to connect. Education is expanding, music and films cross national borders, and state-of-the-art technology affects us all. In this world, an understanding of what culture is and how it happens, can set the foundation for acceptance of differences and respectful disagreements. The science of social psychology—along with the other culture-focused sciences, such as anthropology and sociology—can help produce insights into cultural processes. These insights, in turn, can be used to increase the quality of intercultural dialogue, to preserve cultural traditions, and to promote self-awareness.

Check Your Knowledge

To help you with your studying, we've included some practice questions for this module. These questions do not necessarily address all content in this module. They are intended as practice, and you are responsible for all of the content in this module even if there is no associated practice question. To promote deeper engagement with the material, we encourage you to create some questions of your own for your practice. You can then also return to these self-generated questions later in the course to test yourself.



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Vocabulary

Collectivism

The cultural trend in which the primary unit of measurement is the group. Collectivists are likely to emphasize duty and obligation over personal aspirations.

Cross-cultural psychology (or cross-cultural studies)

An approach to researching culture that emphasizes the use of standard scales as a means of making meaningful comparisons across groups.

Cross-cultural studies (or cross-cultural psychology)

An approach to researching culture that emphasizes the use of standard scales as a means of making meaningful comparisons across groups.

Cultural differences

An approach to understanding culture primarily by paying attention to unique and distinctive features that set them apart from other cultures.

Cultural intelligence

The ability and willingness to apply cultural awareness to practical uses.

Cultural psychology

An approach to researching culture that emphasizes the use of interviews and observation as a means of understanding culture from its own point of view.

Cultural relativism

The principled objection to passing overly culture-bound (i.e., “ethnocentric”) judgements on aspects of other cultures.

Cultural script

Learned guides for how to behave appropriately in a given social situation. These reflect cultural norms and widely accepted values.

Cultural similarities

An approach to understanding culture primarily by paying attention to common features that are the same as or similar to those of other cultures

Culture

A pattern of shared meaning and behavior among a group of people that is passed from one generation to the next.

Enculturation

The uniquely human form of learning that is taught by one generation to another.

Ethnocentric bias (or ethnocentrism)

Being unduly guided by the beliefs of the culture you've grown up in, especially when this results in a misunderstanding or disparagement of unfamiliar cultures.

Ethnographic studies

Research that emphasizes field data collection and that examines questions that attempt to understand culture from it's own context and point of view.

Independent self

The tendency to define the self in terms of stable traits that guide behavior.

Individualism

The cultural trend in which the primary unit of measurement is the individual. Individualists are likely to emphasize uniqueness and personal aspirations over social duty.

Interdependent self

The tendency to define the self in terms of social contexts that guide behavior.

Observational learning

Learning by observing the behavior of others.

Open ended questions

Research questions that ask participants to answer in their own words.

Ritual

Rites or actions performed in a systematic or prescribed way often for an intended purpose. Example: The exchange of wedding rings during a marriage ceremony in many cultures.

Self-construal

The extent to which the self is defined as independent or as relating to others.

Situational identity

Being guided by different cultural influences in different situations, such as home versus workplace, or formal versus informal roles.

Standard scale

Research method in which all participants use a common

scale—typically a Likert scale—to respond to questions.

Value judgment

An assessment—based on one’s own preferences and priorities—about the basic “goodness” or “badness” of a concept or practice.

Value-free research

Research that is not influenced by the researchers’ own values, morality, or opinions.

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71. Gender

Original chapter by Christia Spears Brown,
Jennifer A. Jewell, and Michelle J. Tam
adapted by the Queen's University
Psychology Department

This Open Access chapter was originally written for the NOBA project. Information on the NOBA project can be found below.

We encourage students to use the “Three-Step Method” for support in their learning. Please find our version of the Three-Step Method, created in collaboration with Queen’s Student Academic Success Services, at the following link: <https://sass.queensu.ca/psyc100/>

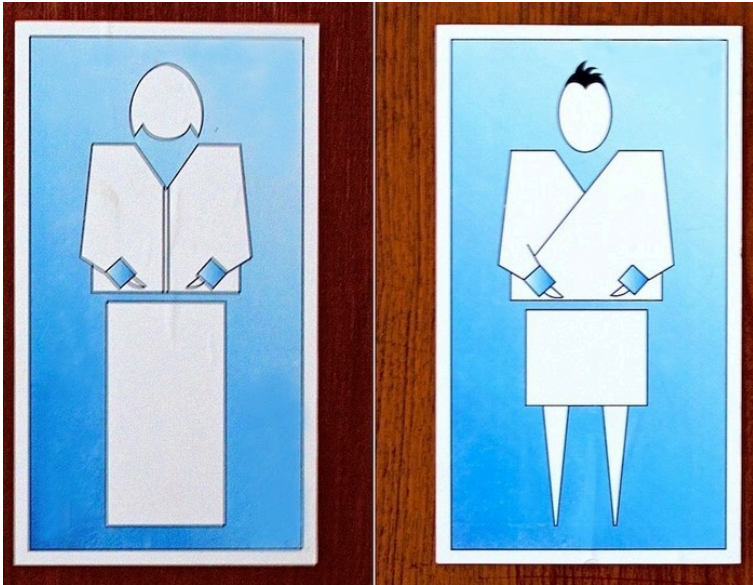
Throughout our content we’ve encouraged you to think about the importance of considering diversity, including sex and gender, when considering questions related to psychology. This module discusses gender and its related concepts, including sex, gender roles, gender identity, sexual orientation, and sexism in more detail. In addition, this module includes a discussion of differences that exist between males and females and how these real gender differences compare to the stereotypes society holds about gender differences. In fact, there are significantly fewer real gender differences than one would expect relative to the large number of stereotypes about gender differences. This module then discusses theories of how gender roles develop and how they contribute to strong expectations for gender differences. Finally, the module concludes with a discussion of some of the consequences of relying on and expecting gender differences, such as gender discrimination, sexual harassment, and ambivalent sexism.

Learning Objectives

- Distinguish gender and sex, as well as gender identity and sexual orientation.
- Discuss gender differences that exist, as well as those that do not actually exist.
- Understand and explain different theories of how gender roles are formed.
- Discuss sexism and its impact on gender.

Introduction

Before we discuss gender in detail, it is important to understand what gender actually is. The terms sex and gender are frequently used interchangeably, though they have different meanings. In this context, **sex** refers to the biological category of male or female, as defined by physical differences in genetic composition and in reproductive anatomy and function. On the other hand, **gender** refers to the cultural, social, and psychological meanings that are associated with masculinity and femininity (**Wood & Eagly, 2002**). You can think of “male” and “female” as distinct categories of sex (a person is typically born a male or a female), but “masculine” and “feminine” as continuums associated with gender (everyone has a certain degree of masculine and feminine traits and qualities).



Gender refers to the cultural, social, and psychological meanings that are associated with masculinity and femininity. [Photo: Michael Foley Photography, <https://goo.gl/B46jym>, CC BY-NC-ND 2.0, <https://goo.gl/aAX82f>]

Beyond sex and gender, there are a number of related terms that are also often misunderstood. **Gender roles** are the behaviors, attitudes, and personality traits that are designated as either masculine or feminine in a given culture. It is common to think of gender roles in terms of **gender stereotypes**, or the beliefs and expectations people hold about the typical characteristics, preferences, and behaviors of men and women. A person's **gender identity** refers to their psychological sense of being male or female. In contrast, a person's **sexual orientation** is the direction of their emotional and erotic attraction toward members of the opposite sex, the same sex, or both sexes. These are important distinctions, and though we will not discuss each of these terms in detail, it is important to recognize that sex, gender, gender identity, and sexual orientation do not always correspond with one another. A

person can be biologically male but have a female gender identity while being attracted to women, or any other combination of identities and orientations.

Defining Gender

Historically, the terms gender and sex have been used interchangeably. Because of this, gender is often viewed as a **binary** – a person is either male or female – and it is assumed that a person's gender matches their biological sex. This is not always the case, however, and more recent research has separated these two terms. While the majority of people do identify with the gender that matches their biological sex (**cisgender**), an estimated 0.6% of the population identify with a gender that does not match their biological sex (**transgender**; Flores, Herman, Gates, & Brown, 2016). For example, an individual who is biologically male may identify as female, or vice versa.

In addition to separating gender and sex, recent research has also begun to conceptualize gender in ways beyond the gender binary. **Genderqueer or gender nonbinary** are umbrella terms used to describe a wide range of individuals who do not identify with and/or conform to the gender binary. These terms encompass a variety of more specific labels individuals may use to describe themselves. Some common labels are **genderfluid**, **agender**, and **bigender**. An individual who is genderfluid may identify as male, female, both, or neither at different times and in different circumstances. An individual who is agender may have no gender or describe themselves as having a neutral gender, while bigender individuals identify as two genders.

It is important to remember that sex and gender do not always match and that gender is not always binary; however,

a large majority of prior research examining gender has not made these distinctions. As such, the following sections will discuss gender as a binary.

The (Trans)Gender-Bathroom Debate

In recent years, there has been much cultural and political debate over the right of transgender individuals to use the public bathroom of their choosing. This debate made major headlines in 2016 when North Carolina passed the Public Facilities Privacy & Security Act (commonly called House Bill 2 or HB2). This law required individuals to use the restroom that corresponded with their birth sex, meaning that transgender individuals could not use the bathroom that matched their gender identity. This law and the similar “bathroom bills” proposed by other states were met with widespread controversy, with opponents arguing that they were discriminatory and perpetuated inequality (Barnett, Nesbit, & Sorrentino, 2018). HB2 has since been repealed, but many states still do not protect the rights of transgender individuals to use their restrooms of choice.

Gender Differences

Differences between males and females can be based on (a) actual gender differences (i.e., men and women are actually different in some abilities), (b) gender roles (i.e., differences in how men and women are supposed to act), or (c) gender stereotypes (i.e., differences in how we *think* men and women are). Sometimes gender stereotypes and gender roles reflect actual gender differences, but sometimes they do not.

What are actual gender differences? In terms of language and language skills, girls develop language skills earlier and know more words than boys; this does not, however, translate into long-term differences. Girls are also more likely than boys to offer praise, to agree with the person they’re talking to, and to elaborate on the other person’s comments; boys, in contrast, are more likely than girls to assert their opinion and offer criticisms (**Leaper & Smith, 2004**). In terms of temperament, boys are slightly less able to suppress inappropriate responses and slightly more likely to blurt things out than girls (**Else-Quest, Hyde, Goldsmith, & Van Hulle, 2006**).



Boys exhibit higher rates of unprovoked physical aggression than girls and are more likely to play organized rough-and-tumble games. [Image: Aislinn Ritchie, <https://goo.gl/cVQ0Ab>, CC BY-SA 2.0, <https://goo.gl/jSSrcO>]

With respect to aggression, boys exhibit higher rates of unprovoked physical aggression than girls, but no difference in provoked aggression (**Hyde, 2005**). Some of the biggest differences involve the play styles of children. Boys frequently play organized rough-and-tumble games in large groups, while girls often play less physical activities in much smaller groups (**Maccoby, 1998**). There are also differences in the rates of depression, with girls much more likely than boys to be depressed after puberty. After puberty, girls are also more likely to be unhappy with their bodies than boys.

However, there is considerable variability between individual males and individual females. Also, even when there are mean level differences, the actual size of most of these differences is quite small. This means, knowing someone's gender does not help much in predicting his or her actual traits. For example, in terms of activity level, boys are considered more active than girls. However, 42% of girls are more active than the average boy (but so are 50% of boys; see Figure 1 for a depiction of this phenomenon in a comparison of male and female self-esteem). Furthermore, many gender differences do not reflect innate differences, but instead reflect differences in specific experiences and socialization. For example, one presumed gender difference is that boys show better spatial abilities than girls. However, Tzuriel and Egozi (2010) gave girls the chance to practice their spatial skills (by imagining a line drawing was different shapes) and discovered that, with practice, this gender difference completely disappeared.

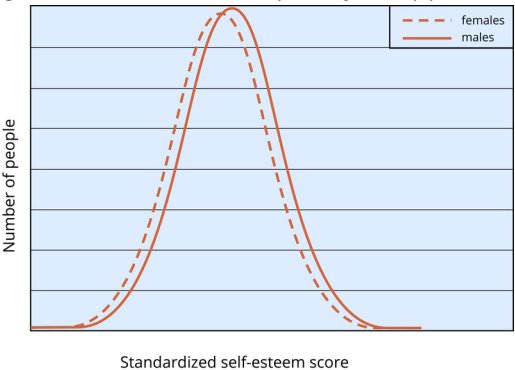


Figure 1. While our gender stereotypes paint males and females as drastically different from each other, even when a difference exists, there is considerable overlap in the presence of that trait between genders. This graph shows the average difference in self-esteem between boys and girls. Boys have a higher average self-esteem than girls, but the average scores are much more similar than different. Taken from Hyde (2005).

Many domains we assume differ across genders are really based on gender stereotypes and not actual differences. Based on large meta-analyses, the analyses of thousands of studies across more than one million people, research has shown: Girls are not more fearful, shy, or scared of new things than boys; boys are not more angry than girls and girls are not more emotional than boys; boys do not perform better at math than girls; and girls are not more talkative than boys (**Hyde, 2005**).

In the following sections, we'll investigate gender roles, the part they play in creating these stereotypes, and how they can affect the development of real gender differences.

Gender Roles

As mentioned earlier, gender roles are well-established social constructions that may change from culture to culture and over time. In American culture, we commonly think of gender roles in terms of **gender stereotypes**, or the beliefs and expectations people hold about the typical characteristics, preferences, and behaviors of men and women.

By the time we are adults, our gender roles are a stable part of our personalities, and we usually hold many gender stereotypes. When do children start to learn about gender? Very early. By their first birthday, children can distinguish faces by gender. By their second birthday, they can label others' gender and even sort objects into gender-typed categories. By the third birthday, children can consistently identify their own gender (see **Martin, Ruble, & Szkrybalo, 2002**, for a review). At this age, children believe sex is determined by external attributes, not biological attributes. Between 3 and 6 years of age, children learn that gender is constant and can't change simply by changing external attributes, having developed **gender constancy**. During this period, children also

develop strong and rigid gender stereotypes. Stereotypes can refer to play (e.g., boys play with trucks, and girls play with dolls), traits (e.g., boys are strong, and girls like to cry), and occupations (e.g., men are doctors and women are nurses). These stereotypes stay rigid until children reach about age 8 or 9. Then they develop cognitive abilities that allow them to be more flexible in their thinking about others.



Figure 2: Children develop the ability to classify gender very early in life.

How do our gender roles and gender stereotypes develop and become so strong? Many of our gender stereotypes are so strong because we emphasize gender so much in culture (**Bigler & Liben, 2007**). For example, males and females are treated differently before they are even born. When someone learns of a new pregnancy, the first question asked is “Is it a boy or a girl?” Immediately upon hearing the answer, judgments are made about the child: Boys will be rough and like blue, while girls will be delicate and like pink. **Developmental intergroup theory** postulates that adults’ heavy focus on gender leads children to pay attention to gender as a key source of information about themselves and others, to seek out any possible gender differences, and to form rigid stereotypes based on gender that are subsequently difficult to change.



People are more likely to remember schema-consistent behaviors and attributes than schema-inconsistent behaviors and attributes. For example, people are more likely to remember men, and forget women, who are firefighters. [Photo: Billy V, <https://goo.gl/Kb2MuL>, CC BY-NC-SA 2.0, <https://goo.gl/Toc0ZF>]

There are also psychological theories that partially explain how children form their own gender roles after they learn to differentiate based on gender. The first of these theories is **gender schema theory**. Gender schema theory argues that children are active learners who essentially socialize themselves. In this case, children actively organize others' behavior, activities, and attributes into gender categories, which are known as **schemas**. These schemas then affect what

children notice and remember later. People of all ages are more likely to remember schema-consistent behaviors and attributes than schema-inconsistent behaviors and attributes. So, people are more likely to remember men, and forget women, who are firefighters. They also misremember schema-inconsistent information. If research participants are shown pictures of someone standing at the stove, they are more likely to remember the person to be cooking if depicted as a woman, and the person to be repairing the stove if depicted as a man. By only remembering schema-consistent information, gender schemas strengthen more and more over time.

A second theory that attempts to explain the formation of gender roles in children is **social learning theory**. Social learning theory argues that gender roles are learned through reinforcement, punishment, and modeling. Children are rewarded and reinforced for behaving in concordance with gender roles and punished for breaking gender roles. In addition, social learning theory argues that children learn many of their gender roles by modeling the behavior of adults and older children and, in doing so, develop ideas about what behaviors are appropriate for each gender. Social learning theory has less support than gender schema theory—research shows that parents do reinforce gender-appropriate play, but for the most part treat their male and female children similarly (Lytton & Romney, 1991).

Gender Sexism and Socialization

Treating boys and girls, and men and women, differently is both a *consequence* of gender differences and a *cause* of gender differences. Differential treatment on the basis of gender is also referred to **gender discrimination** and is an inevitable consequence of gender stereotypes. When it is

based on unwanted treatment related to sexual behaviors or appearance, it is called **sexual harassment**. By the time boys and girls reach the end of high school, most have experienced some form of sexual harassment, most commonly in the form of unwanted touching or comments, being the target of jokes, having their body parts rated, or being called names related to sexual orientation.

Different treatment by gender begins with parents. A meta-analysis of research from the United States and Canada found that parents most frequently treated sons and daughters differently by encouraging gender-stereotypical activities (Lytton & Romney, 1991). Fathers, more than mothers, are particularly likely to encourage gender-stereotypical play, especially in sons. Parents also talk to their children differently based on stereotypes. For example, parents talk about numbers and counting twice as often with sons than daughters (Chang, Sandhofer, & Brown, 2011) and talk to sons in more detail about science than with daughters. Parents are also much more likely to discuss emotions with their daughters than their sons.

Children do a large degree of socializing themselves. By age 3, children play in gender-segregated play groups and expect a high degree of conformity. Children who are perceived as gender atypical (i.e., do not conform to gender stereotypes) are more likely to be bullied and rejected than their more gender-conforming peers.

Gender stereotypes typically maintain gender inequalities in society. The concept of **ambivalent sexism** recognizes the complex nature of gender attitudes, in which women are often associated with positive and negative qualities (Glick & Fiske, 2001). It has two components. First, **hostile sexism** refers to the negative attitudes of women as inferior and incompetent relative to men. Second, **benevolent sexism** refers to the perception that women need to be protected, supported, and adored by men. There has been considerable empirical support

for benevolent sexism, possibly because it is seen as more socially acceptable than hostile sexism. Gender stereotypes are found not just in American culture. Across cultures, males tend to be associated with stronger and more active characteristics than females (**Best, 2001**).

In recent years, gender and related concepts have become a common focus of social change and social debate. Many societies, including American society, have seen a rapid change in perceptions of gender roles, media portrayals of gender, and legal trends relating to gender. For example, there has been an increase in children's toys attempting to cater to both genders (such as Legos marketed to girls), rather than catering to traditional stereotypes. Nationwide, the drastic surge in acceptance of homosexuality and gender questioning has resulted in a rapid push for legal change to keep up with social change. Laws such as "Don't Ask, Don't Tell" and the Defense of Marriage Act (DOMA), both of which were enacted in the 1990s, have met severe resistance on the grounds of being discriminatory toward sexual minority groups and have been accused of unconstitutionality less than 20 years after their implementation. Change in perceptions of gender is also evident in social issues such as sexual harassment, a term that only entered the mainstream mindset in the 1991 Clarence Thomas/Anita Hill scandal. As society's gender roles and gender restrictions continue to fluctuate, the legal system and the structure of American society will continue to change and adjust.

Important Gender-related Events in the United States

1920 — *19th Amendment* (women's Suffrage Ratified)

1941-1945 — World War II forces millions of women to enter the workforce

1948 — Universal Declaration of Human Rights

1963 — Congress passes *Equal Pay Act*

1964 — Congress passes *Civil Rights Act*, which outlaws sex discrimination

1969 — Stonewall riots in NYC, forcing gay rights into the American spotlight

1972 — Congress passes *Equal Rights Amendment*; Title IX prohibits sex discrimination in schools and sports

1973 — American Psychiatric Association removes homosexuality from the DSM

1981 — First woman appointed to the US Supreme Court

1987 — Average woman earned \$0.68 for every \$1.00 earned by a man

1992 — World Health Organization no longer considers homosexuality an illness

1993 — Supreme Court rules that sexual harassment in the workplace is illegal

2011 — *Don't Ask Don't Tell* is repealed, allowing people who identify as gay serve openly in the US military

2012 — President Barack Obama becomes the first American president to openly support LGBT rights and marriage equality

The Queen's Positive Space Program

Queen's University has a program dedicated to celebrating sexual and gender diversity. We encourage you to learn more about this great program here: <https://www.queensu.ca/positivespace/home>

Studying Gender and Sexuality in Queen's

Psychology

If you are interested in learning more about topics related to gender and sexuality, we encourage you to consider the following courses:

PSYC333: Human Sexuality

PSYC366: Gender, Hormones, and Behaviour (Note, the course code for this course will be updated in 2021)

PSYC433: Human Sexual Function and Dysfunction

PSYC436: Sexuality and Gender

Outside Resources

Web: Understanding Prejudice: Sexism

<http://www.understandingprejudice.org/links/sexism.htm>

Vocabulary

Agender

An individual who may have no gender or may describe themselves as having a neutral gender.

Ambivalent sexism

A concept of gender attitudes that encompasses both positive and negative qualities.

Benevolent sexism

The “positive” element of ambivalent sexism, which recognizes that women are perceived as needing to be protected, supported, and adored by men.

Bigender

An individual who identifies as two genders.

Binary

The idea that gender has two separate and distinct categories (male and female) and that a person must be either one or the other.

Cisgender

A term used to describe individuals whose gender matches their biological sex.

Developmental intergroup theory

A theory that postulates that adults' focus on gender leads children to pay attention to gender as a key source of information about themselves and others, to seek out possible gender differences, and to form rigid stereotypes based on gender.

Gender

The cultural, social, and psychological meanings that are associated with masculinity and femininity.

Gender constancy

The awareness that gender is constant and does not change simply by changing external attributes; develops between 3 and 6 years of age.

Gender discrimination

Differential treatment on the basis of gender.

Gender identity

A person's psychological sense of being male or female.

Gender roles

The behaviors, attitudes, and personality traits that are designated as either masculine or feminine in a given culture.

Gender schema theory

This theory of how children form their own gender roles

argues that children actively organize others' behavior, activities, and attributes into gender categories or schemas.

Gender stereotypes

The beliefs and expectations people hold about the typical characteristics, preferences, and behaviors of men and women.

Genderfluid

An individual who may identify as male, female, both, or neither at different times and in different circumstances.

Genderqueer or gender nonbinary

An umbrella term used to describe a wide range of individuals who do not identify with and/or conform to the gender binary.

Hostile sexism

The negative element of ambivalent sexism, which includes the attitudes that women are inferior and incompetent relative to men.

Schemas

The gender categories into which, according to gender schema theory, children actively organize others' behavior, activities, and attributes.

Sex

Biological category of male or female as defined by physical differences in genetic composition and in reproductive anatomy and function.

Sexual harassment

A form of gender discrimination based on unwanted treatment related to sexual behaviors or appearance.

Sexual orientation

Refers to the direction of emotional and erotic attraction toward members of the opposite sex, the same sex, or both sexes.

Social learning theory

This theory of how children form their own gender roles argues that gender roles are learned through reinforcement, punishment, and modeling.

Transgender

A term used to describe individuals whose gender does not match their biological sex.

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