

The effect of first language on intelligibility

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This study consists of two parts. The first part is the report of two experiments carried out to see the effect of a shared first language (L1) on second language (L2) intelligibility. The concern of the investigation was specifically pronunciation and phonological factors. The second part deals with pronunciation errors of Mandarin and Vietnamese speakers that are motivated by their respective phonological systems, thus providing help with designing pronunciation teaching materials.

The study was started with the following research question: Do English learners understand each other better in English when they share the same first language? This L1 effect is sometimes referred to as Interlanguage Speech Intelligibility Benefit (Bent & Bradlow 2003), and it is not a new question, but the results of previous studies do not converge; whereas some researchers have found an L1 effect to exist, others have come up with evidence to the contrary. For example, Imai et al. (2005) showed that listening to Spanish talkers, Spanish listeners did better than native English listeners in a word recognition task, and Xie & Fowler (2013) reported that Mandarin listeners outperformed English listeners in identifying Mandarin-accented speech. This shared L1 effect has been suggested to exist more in low-proficiency learners (Wijngaarden et al. 2002, Stibbard & Lee 2006, and Hayes-Harb et al. 2008). On the other hand, Munro et al. (2012) saw no effect of L1 among Cantonese, Mandarin, Russian, Ukrainian, and English subjects, listening to Cantonese-accented speech, and Crowther et al. (2016) observed no difference among French, Mandarin, and English listeners in listening to French-accented English. There has also been some evidence of a negative L1 effect, e.g., Ingram & Nguyen (2007) found that Vietnamese-accented English was more intelligible to English native listeners than to Vietnamese listeners. The present investigation tried to shed some light on the issue with the following two experiments.

To measure the intelligibility of speech, talkers and listeners of different L1s were used. Two experiments were carried out. The first concerned English and Mandarin and the second Vietnamese and Korean. The research was approved after undergoing ethical review. The audio recordings of English sentences produced by different talkers were played for different listeners, who were asked to transcribe what they heard. Based on the number of correct keywords written, the intelligibility score was calculated. The results indicate that L1 does influence intelligibility, i.e., talkers who share the same L1 understand each other better. The details of the experiments follow.

Experiment 1

Participants and method

The recordings of two Mandarin talkers (1 female) and two English talkers (1 female) were used, and the number of listeners was 31 Mandarin and 45 non-Mandarin. The listeners were all full-time intermediate and upper intermediate English as a second language (ESL) students, studying at Centennial College's ELL Program. All participants were compensated with a Tim Horton's gift card. The measurement of intelligibility was

done through a technique named the dictée task, originally introduced by Brodkey (1972) and subsequently used in other studies. (For a summary of measurement techniques, see Munro 2008: 201.) The dictée task involves playing stimulus sentences for subjects and asking them to write what they heard. The intelligibility score is then calculated by counting the number of words transcribed correctly. The recordings of this experiment came from the Wildcat Corpus of Native- and Foreign-Accented English database (Van Engen et al. 2010), from which 60 sentences by four talkers (two Mandarin and two English) were used, i.e., 15 sentences each.

The transcription part was done in groups. The listeners were given an answer sheet each and were asked to transcribe what they heard. The files were played in a different order for each group. Each sentence was played only once, after which the research assistant paused the recording and visually monitored the listeners until he made sure everyone was done writing, and then went on to play the next sentence. The sentences had 3–5 keywords each, based on the correct transcription of which the intelligibility score percentage was calculated. No points were deducted for minor spelling errors.

Results

The intelligibility scores appear in Figure 1, which contains the correct transcription percentage of different listener-talker pairs; for example, the blue bar indicates that non-Mandarin listeners understood English talkers 59% of the time.

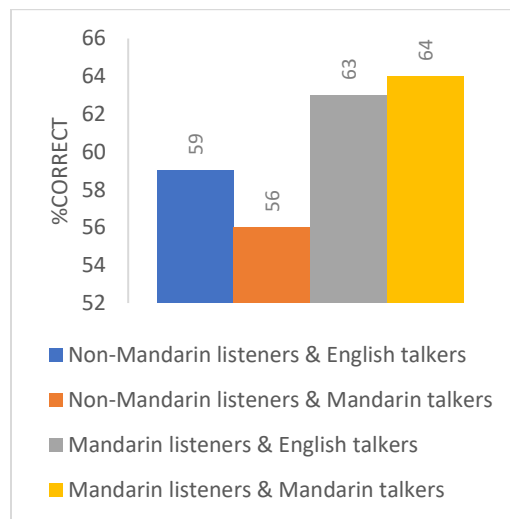


Figure 1: Intelligibility scores in percentage. From left to right, the bars represent the pairs: Non-Mandarin listeners & English talkers; Non-Mandarin listeners & Mandarin talkers; Mandarin listeners & English talkers; Mandarin listeners & Mandarin talkers

A two-way ANOVA with listener and talker as independent variables and intelligibility score as dependent variable showed nonsignificant difference for talker and listener-talker interaction, but the listener effect was significant (an asterisk indicates statistical significance): Listener: $F(1,78)=7.34, p<0.01^*$

To confirm this further, *t*-tests were performed, which yielded the following results:

Listeners	Talkers		<i>t</i> -value
	Mandarin	English	
Mandarin	64	63	$t(30)=0.22, p=0.82$
Non-Mandarin	56	59	$t(44)=2.78, p=0.01^*$

Talkers	Listeners		<i>t</i> -value
	Mandarin	Non-Mandarin	
Mandarin	64	56	$t(74)=2.64, p=0.01^*$
English	63	59	$t(74)=1.22, p=0.22$

As can be seen, there is a significant difference in two of the cases. First, non-Mandarin listeners understood English talkers significantly more than they understood Mandarin talkers, and second, Mandarin listeners understood Mandarin talkers significantly more than non-Mandarin listeners did. In the other two cases, no effect was observed. Mandarin listeners showed no significant difference in understanding Mandarin and English, and Mandarin and non-Mandarin listeners showed no significant difference in understanding English talkers. Interpreted together, the results of these tests suggest that whenever the communication involved Mandarin talkers on one end and non-Mandarin listeners on the other, there was more chance of unintelligibility. To further confirm the findings with other languages, a similar experiment was carried out with Vietnamese and Korean L1s, the details of which follow.

Experiment 2

Participants and method

One Vietnamese (female) and one Korean (male) talker, and 14 Vietnamese and 13 Korean listeners took part in the experiment. The participants were students at Centennial College's ELL Program, enrolled in full-time intermediate and upper intermediate courses. They received a Tim Horton's gift card for their time. Each talker recorded 15 sentences, which were taken from Bent & Bradlow (2003). The participants were presented with the sentences in written form and were asked to read them in a natural way, leaving a small pause between the items. If they made a mistake, they were instructed to record the item again. The dictée task was done identically to experiment 1. The groups of listeners were provided with an answer sheet each, on which they transcribed what they heard. They heard each sentence once but were given ample time to write it.

Results

The percentage of keywords transcribed correctly is given in Figure 2.

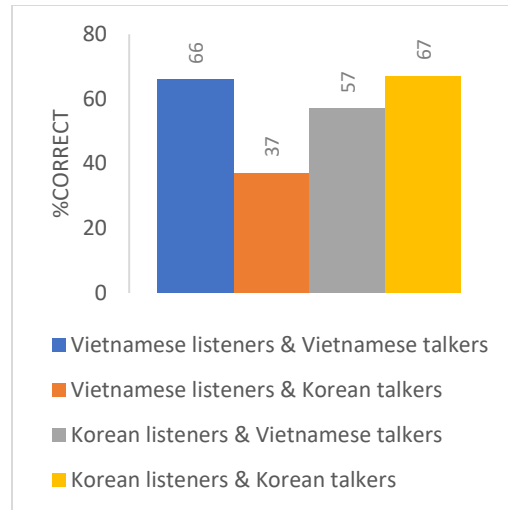


Figure 2: Intelligibility scores in percentage. From left to right, the bars represent the pairs: Vietnamese Listeners & Vietnamese talkers; Vietnamese Listeners & Korean talkers; Korean Listeners & Vietnamese talkers; Korean Listeners & Korean talkers

A two-way ANOVA with listener and talker as independent variables and intelligibility score as dependent variable determined a significant effect for all cases:

Listener: $F(1,27)=6.87, p=0.01^*$

Talker: $F(1,27)=9.51, p<0.01^*$

Listener-talker interaction: $F(1,27)=42.88, p<0.01^*$

T-tests corroborated the above results:

Listeners	Talkers		t-value
	Vietnamese	Korean	
Vietnamese	66	37	$t(12)=8.78, p<0.01^*$
Korean	57	67	$t(13)=4.34, p<0.01^*$

Talkers	Listeners		t-value
	Vietnamese	Korean	
Vietnamese	66	57	$t(25)=3.12, p<0.01^*$
Korean	37	67	$t(25)=5.90, p<0.01^*$

There is a significant effect observed in all cases, which means that Vietnamese and Korean listeners found the speech of those who shared their L1 more intelligible.

Discussion

These experiments were designed to determine the effect of first language on intelligibility. The results of both experiments point in the same direction: when non-native English speakers communicate, the listener comprehends the speaker to a higher degree if they share the same first language. It is reasonable to conclude that one of the causes of this enhanced level of intelligibility is a shared phonological system. For instance, when a Vietnamese listener understands a Vietnamese talker better than a Korean talker, a contributing factor can be seen as the specific characteristics of Vietnamese phonology. For example, upon hearing the word *rice* pronounced as *rye* (without the final /s/) by a fellow native speaker, a Vietnamese listener may understand it correctly as the intended word *rice*. Being subconsciously aware of a phonological rule in Vietnamese that disallows an /s/ at the end of a syllable, and so a Vietnamese listener mentally may add this /s/ to the end of *rye*, comprehending it as *rice*.

The findings so far motivated the next research question: what are the typical pronunciation errors caused by L1 phonology interference? Accounting for L2 pronunciation through L1 features has its roots in the Contrastive Analysis Hypothesis (Lado 1957). This view attributes the errors in L2 learning to the linguistic features of the L1. This approach has faced criticism throughout the years, for example, that it ignores individual learner differences or that it considers all errors to be of equal importance (Derwing & Munro 2015, Munro 2018). While the above criticisms are valid, having knowledge of the learners' L1 can be helpful for pronunciation teachers (if other contributing factors such as age and previous learning experience of a learner are not ignored) (Brinton 2018).

Thus, the next stage of the study aimed at detecting the errors made by Mandarin and Vietnamese speakers and accounting for them in terms of the phonology of the two languages, on which the following sources, among others, were consulted: Avery & Ehrlich (1992), Swan & Smith (2001), Duanmu (2007), Třískova (2011), for Mandarin; and Thompson (1987), Avery & Ehrlich (1992), Hwa-Froelich et al. (2002), Ha (2005), Tang (2007), for Vietnamese. The found error patterns act as a guide to writing teaching materials for ESL pronunciation courses. The errors were gleaned from the recordings of the author's Mandarin and Vietnamese students, 34 Mandarin (14 female) and 27 Vietnamese (12 female) speakers. The total durations of the recordings were 181 and 109 minutes for Mandarin and Vietnamese, respectively, and they included both scripted and spontaneous speech.

Error categories

The following error categories were found.¹

a) Consonant deletion

¹ The IPA system has been implemented throughout the paper. The pronunciation used as a frame of reference is based on Canadian English (e.g., Boberg 2008). Some simplifications have been applied where necessary to arrive at a more unified presentation; for example, the vowel of *solve* can be /ɒ/, /ɑ/, or /ɔ/ depending on regional or social factors but has been transcribed as /ɑ/.

The deleted consonant was mostly syllable-final. The deletion occurred for two reasons. One was phonotactic constraints; for example, the dropping of /f/ in *life* as the syllable coda constraint allow only /n, ŋ/ in Mandarin and /p, t, k, m, n, ŋ/ in Vietnamese in syllable-final position, or the dropping of /t/ in *about* by Vietnamese speakers due to the impermissibility /t/ after the diphthong /aʊ/ (or an /aʊ/-like Vietnamese phoneme, to be precise). The other factor motivating the deletion was the lack of (an exact) counterpart in the L1 inventory, e.g., /dʒ/ in Vietnamese. The abbreviations Man., Viet., and N.O. in the tables stand for Mandarin, Vietnamese, and Not Observed, respectively.

Change	Examples	Man.	Viet.
/t/ → Ø	<i>favour<u>i</u>te, out, that, but, polit<u>e</u>ly, not</i> (Man.); <i>about, quite, straight, might, formul<u>a</u>te, consolid<u>a</u>te, out, communic<u>a</u>te, roommat<u>e</u>, appreciat<u>e</u>, outdoo<u>r</u></i> (Viet.)	√	√
/d/ → Ø	<i>good<u>d</u> looking, attitud<u>e</u>, could, repeated<u>l</u>y</i> (Man.); <i>provid<u>e</u>, wide, advic<u>e</u>, childhoo<u>d</u></i> (Viet.)	√	√
/k/ → Ø	<i>bak<u>e</u></i> (Man.); <i>diction<u>a</u>ry, reflect<u>i</u>on, act<u>i</u>on, lik<u>e</u></i> (Viet.)	√	√
/m/ → Ø	<i>nam<u>e</u></i>	√	N.O.
/b/ → Ø	<i>describ<u>e</u></i>	N.O.	√
/g/ → Ø	<i>Englis<u>h</u></i>	N.O.	√
/f/ → Ø	<i>lif<u>e</u></i>	N.O.	√
/v/ → Ø	<i>five, improv<u>e</u></i>	N.O.	√
/s/ → Ø ²	<i>plac<u>e</u>, this, advic<u>e</u>, increas<u>e</u>, practic<u>e</u>, reduc<u>e</u>, nic<u>e</u>, successfu<u>l</u>, semest<u>e</u>r, distric<u>t</u></i>	N.O.	√
/z/ → Ø	<i>is, always, Vietnames<u>e</u>, thos<u>e</u>, becaus<u>e</u>, was, usefu<u>l</u>, Tuesd<u>a</u>y</i>	N.O.	√
/dʒ/ → Ø	<i>hug<u>e</u>, origin<u>a</u>l</i>	N.O.	√
/n/ → Ø	<i>town<u>u</u>, hometow<u>n</u>, design<u>u</u>, fin<u>e</u>, onl<u>y</u></i>	N.O.	√
/l/ → Ø	<i>whil<u>e</u></i>	N.O.	√

b) Consonant cluster simplification

Consonant clusters are generally not allowed in Mandarin and Vietnamese, so learners tended to do one of the following:

- i) Delete one or more consonants:

Change	Examples	Man.	Viet.
/t/ → Ø (/ts/ → /s/, /rt/ → /r/, /kt/ → /k/, /nt/ → /n/, /lt/ → /l/, /st/ → /s/)	<i>stat<u>e</u>s, jacks<u>e</u>t, start, short, protect</i> (Man.); <i>demonstrat<u>e</u>s, percent, point, assignment, felt, result, based</i> (Viet.)	√	√

² Interestingly, the reverse trend was also observed, i.e., adding /s/ (or sometimes /z/) to the end of words (*restaurant, turn, food, guy, hundred, lecture, key, reason, again, me, main, design, thing*), which may be explained through overgeneralization, whereby a Vietnamese speaker who subconsciously knows the possibility of an /s/ being deleted in his/her pronunciation adds an unnecessary /s/ where not needed.

/d/ → Ø (/nd/→/n/, /dr/→/r/, /rld/→/rl/)	<i>found</i> (Man.); <i>friend</i> , <i>and</i> <i>around</i> , <i>dream</i> , <i>world</i> (Viet.)	√	√
/k/ → Ø (/ks/→/s/, /kt/→/t/, /kl/→/l/, /ŋk/→/ŋ/, /sk/→/s/)	<i>accepted</i> , <i>district</i> (Man.); <i>experience</i> , <i>explain</i> , <i>express</i> , <i>district</i> , <i>conclusion</i> , <i>function</i> , <i>think</i> , <i>ask</i> (Viet.)	√	√
/s/ → Ø (/ks/→/k/, /str/→/tr/, /st/→/t/, /rst/→/rt/, /ns/→/n/)	<i>expression</i> , <i>expensive</i> (Man.); <i>sixteen</i> , <i>stress</i> , <i>demonstrates</i> , <i>fast</i> , <i>best</i> , <i>most</i> , <i>last</i> , <i>first</i> , <i>since</i> , <i>experience</i> , <i>chance</i> , <i>science</i> (Viet.)	√	√
/z/ → Ø (/rz/→/r/, /rdz/→/rd/, /lz/→/l/)	<i>cars</i> , <i>words</i> (Man.); <i>animals</i> (Viet.)	√	√
/dʒ/ → Ø (/ndʒ/→/n/)	<i>change</i> (Man.); <i>change</i> (Viet.)	√	√
/ʃ/ → Ø (/rʃ/→/r/)	<i>research</i>	N.O.	√
/n/ → Ø (/nd/→/d/)	<i>find out</i> , <i>kind</i>	N.O.	√
/j/ → Ø (/hj/→/h/)	<i>human</i>	N.O.	√
/ks, sk, st, nd, ld/ → Ø	<i>sixty</i> , <i>ask</i> , <i>first</i> , <i>next</i> , <i>kind</i> , <i>find</i> , <i>mind</i> , <i>old</i>	N.O.	√

ii) Insert or substitute a vowel to add a syllable:

Change	Examples	Man.	Viet.
/ə/ insertion /kam.plɛks/ → /kam.pə.lɛks/ /ɪŋ.gliʃ/ → /ɪŋ.gə.liʃ/ /kloʊðz/ → /kə.loʊðz/ /pɪkt/ → /pɪ.kəd/	<i>complex</i> , <i>English</i> , <i>clothes</i> , <i>picked</i>	√	N.O.
/i/ insertion /ʃem.dʒ#/ → /ʃem.dʒi/	<i>change</i>	√	N.O.
Consonant substituted with /ə/ (/k/→/ə/, /d/→/ə/)	<i>accept</i> , <i>socks</i> , <i>next</i> , <i>wind</i> (Man.); <i>spend</i> , <i>friend</i> , <i>and</i> (Viet.)	√	√

c) Phoneme switching

The English phonemes that are not found in Mandarin and Vietnamese – or are not identical to the English counterpart – e.g., /v, ð, θ, z, h, æ, ɪ/ (Mandarin) and /ð, θ, dʒ, ʃ, ɪ, æ, ʊ, eɪ, aɪ, aʊ/ and syllable-initial /p/ (Vietnamese), caused the most switching. The other motivation for switching was phonotactic constraints, e.g., the syllable coda constraint (see case a above), for example, the b→k switch in *problem* for Vietnamese learners.

Change	Examples	Man.	Viet.
Consonants			
/v/ → /f/	<i>I've made³</i>	√	N.O.
/v/ → /w/	<i>video, unmoving, advice, lovers, over</i>	√	N.O.
/θ/ → /s/	<i>think, third, thought, thirty, thousand, things, something, rethink, nothing, mouth, with</i>	√	N.O.
/θ/ → /t/	<i>thank, think, thinking, third, thirdly, thing, theory, thought, author</i>	N.O.	√
/ð/ → /d/	<i>that, them (Man.); that (Viet.)</i>	√	√
/ð/ → /z/	<i>the, although (Man.); the (Viet.)</i>	√	√
/z/ → /s/	<i>business, designer, caused, is, ideas, because, as, shoes</i>	√	N.O.
/h/ → /x/	<i>how</i>	√	N.O.
/p/ → /b/	<i>product, people, part, point, past, peaceful, place, personally, process, problem, perfect, positive, simple, propose, improve, example</i>	N.O.	√
/b/ → /k/	<i>problem</i>	N.O.	√
/s/ → /t/	<i>experience</i>	N.O.	√
/s/ → /k/	<i>interesting, introduce</i>	N.O.	√
/ʃ/ → /k/	<i>English</i>	N.O.	√
/ʃ/ → /s/ ⁴	<i>shelter, shop, should, special, especially, conscious, pressure, T-shirt, English, fresh, wish</i>	N.O.	√
/ʒ/ → /s/	<i>much, beach</i>	N.O.	√
/ʒ/ → /t/	<i>much</i>	N.O.	√
/ʒ/ → /k/	<i>which</i>	N.O.	√
/dʒ/ → /d/	<i>garbage</i>	N.O.	√
/l/ → /n/	<i>basketball, baseball, call, all</i>	N.O.	√
Vowels/Diphthongs			
/æ/ → /ɛ/	<i>action</i>	√	N.O.
/æ/ → /ə/	<i>fast, understand, fashion (Man.); practice (Viet.)</i>	√	√
/æ/ → /ɑ/	<i>man, Frank, language, band, popularity, carrots (Man.); attitude, activity (Viet.)</i>	√	√
/æ/ → /eɪ/	<i>ran</i>	√	N.O.
/æ/ → /aɪ/	<i>as</i>	√	N.O.
/ɪ/ → /i/	<i>practice, especially, live, picking, tripped, kitchen (Man.); city (Viet.)</i>	√	√

³ In syllable-final phoneme switches, a final devoicing rule may have been at work (Hansen 2001), e.g., changing /arv/ to /arʃ/ in this example. Also note that in such examples, the final consonant deletion strategy was not employed as in case a above, e.g., /arv/ was not rendered as /ar/, possibly to make a distinction between the present perfect and the simple past.

⁴ The /ʃ/ sound exists in Vietnamese (a retroflex /s/, to be exact) and is represented by the letter s; however, it is regionally pronounced as /s/, e.g., in the north, and this seems to be the motivation behind this switch. Interestingly, the switch was seen in the opposite direction as well (s→ʃ: *go, solve, accent, mistake, professor, specific, pronunciation*), which may be due to overgeneralization, i.e., using /ʃ/ when it is not needed, in order to sound correct.

/eɪ/ → /ɛ/ ⁵	<i>main, came, painting, take, painful, same, waste</i> (Man.); <i>same, awake, brain, main, taking</i> (Viet.)	√	√
/oʊ/ → /ɑ/	<i>notice</i>	N.O.	√
/oʊ/ → /o/	<i>overcome</i>	N.O.	√
/aɪ/ → /ɑ/	<i>time</i>	N.O.	√
/aʊ/ → /ɑ/	<i>pronounce</i>	N.O.	√

It is also notable that in both groups of learners, some vowels seem to have been switched due to the influence of orthography. For example, in the word *heroes*, the first *e* was rendered as /ɛ/, which is a common pronunciation of this letter in many words such as *hen* or *bed*:

Letter(s) influencing the change	Change	Examples
<i>a</i>	/ə/ → /ɑ/	<i>dollar</i>
<i>e</i>	/i/ → /ɛ/	<i>heroes, theory</i>
<i>ea</i>	/ɛ/ → /i/	<i>wear, wearing</i>
<i>o</i>	/ɑ/ → /o/ /ə/ → /o/ /u/ → /o/	<i>on, honest, model, dollar, modern, cost, following, solve, symbolic, follow of, carrots, purpose, theory, other unmoving</i>
<i>ou</i>	/ɑ/ → /aʊ/	<i>thought, bought</i>
<i>u</i>	/ə/ → /ʊ, u/	<i>lucky, beautiful</i>

d) Word stress misplacement

Mandarin is a tonal language, and tone, similar to stress in English, is used to distinguish word meaning (Zhang et al. 2008). Thus, this language lacks word stress, at least in the sense that English has it. Vietnamese is also a tonal language and does not have culminative word stress (Nguyen & Ingram 2006). Consequently, many examples of stress misplacement were seen in the data:

Nouns: *workmánsnip, atmósphere, indústry, distríct, purpóse, intervíew, váriety, imáges, táttoo, supermárket, reasón, architécture, languáge, místake, formúla, services, procésses, Canadá, manágement, prográm, subtitle, English, vehícle, indivíduality, réspedes*

Adjectives: *únique, interésting, ártistic, comfórtable, rómantic, unnecéssary, psychólogical, limítless, complicáted, informátive, sýmbolic, spécific, confídent*

Verbs: *realíze, encouráge, immigráte, diminíshing, continúe*

⁵ Although the diphthong /eɪ/ exists in Mandarin, the reason for this error has been suggested to be that as /eɪ/ cannot be followed by a final consonant in this language, any such consonant distorts and shortens the diphthong to /ɛ/ (Huang & Radant 2009).

Adverbs: *constántly, accidentally, áccidentally, logically*

Pronouns: *everything, something, everywhére*

Conclusion

The first part of this research included experiments whose results suggest an effect of first language on intelligibility, meaning that communicators who share the same L1 may understand each other better. The second part focused on pronunciation errors of Mandarin and Vietnamese speakers and tried to account for these errors in terms of the phonological properties of a learner's L1. Overall, the findings of this paper demonstrate that a learner's L1 can be seen as a source of L2 pronunciation errors. Previous research suggests that familiarity with L1 facilitates intelligibility (Clarke & Garrett 2004, Bradlow & Bent 2008), and the findings here point in the same direction and can be used as a guide in designing pronunciation teaching materials.

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