

Perception of Unfamiliar English Phonemes by Native Mandarin Speakers

Gabriela Holko¹, Scott James Perry¹, Matthew C. Kelley¹, Benjamin V. Tucker¹

¹Department Linguistics, University of Alberta

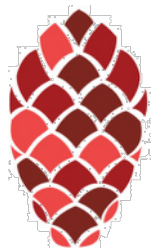
Abstract

In second language acquisition, speech sounds, or phonemes, not present in a learner's native language often pose an extra challenge for speech production. When hearing one of these unfamiliar phonemes, the learner either maps it to a similar native phoneme, perceives it as a completely foreign sound, or does not perceive it as speech at all. In the first case, the learner is unable to perceive a difference between the unfamiliar phoneme and the native phoneme to which it is mapped. This mapping difficulty potentially creates problems for the learner during word recognition. The present research investigated the extent to which English phonemes absent from the Mandarin phonological inventory impact processing of native Mandarin speakers in an auditory lexical decision task. Results of this research will expand the understanding of second language perception, especially within the context of auditory lexical decision tasks. A list of ten phonemes—/ɪ/, /æ/, /ʊ/, /ɛ/, /ɪ/, /z/, /ʒ/, /ə/, /ð/, /dʒ/—present in the English phonological inventory but absent from that of Mandarin were identified as unfamiliar to native Mandarin speakers. Data from the Massive Auditory Lexical Decision (MALD) database, in which participants decided whether recorded utterances were English words or made-up words, were utilized. The effects of the proportion of unfamiliar phonemes, proportion of unfamiliar vowels, and proportion of unfamiliar consonants on reaction time, representative of processing difficulty, were then calculated using statistical techniques. It was found that the proportion of all unfamiliar phonemes in an utterance had no significant effect on the reaction time of the native Mandarin speakers. However, when the list of unfamiliar phonemes was divided into vowels and consonants, a greater proportion of unfamiliar vowels was noticed to increase reaction time, while a greater proportion of unfamiliar consonants was found to decrease reaction time. Further research in this area is required to determine a concrete explanation for these results. Interestingly, when the same analysis was performed on the data of native English speakers, similar results were observed. This may reflect a common language processing mechanism in second language learners and native speakers.

Key words:

auditory lexical decision, spoken word recognition, second language perception, L2, L2 perception, L1 Mandarin, L2 English

Cite as: Holko G., Perry, S.J., Kelley M.C., and Tucker B.V. 2019. Perception of unfamiliar English phonemes by native Mandarin speakers. *Alberta Academic Review*, Vol 2 (2) 37-38, WISEST Special Issue (not peer-reviewed), DOI 10.29173/aar46.



1. Introduction

- In second language (L2) acquisition, basic sounds (phonemes) not present in a learner's native language (L1) pose an extra challenge for speech production (Table 1) [2,3]
 - When hearing one of these unfamiliar phonemes, the learner either maps it to a similar L1 phoneme, perceives it as a completely foreign sound, or does not perceive it as speech [2]
 - In the first case, the learner is unable to perceive a difference between the unfamiliar phoneme and the native phoneme to which it is mapped [2]
- Research question**
- To what extent do English phonemes absent from the Mandarin phonological inventory impact the response time of native Mandarin speakers in an auditory lexical decision task?

2. Method

Sample

- 71 native Mandarin speakers with L2 English
 - 49 female; age 17 to 25 (M = 20.38, SD = 1.75); Age of Acquisition (AoA) 4 to 18 (M = 8.89, SD = 3.24); 1 to 22 years in Canada (M = 4.87, SD = 5.08)

Experiment

- Data from the Massive Auditory Lexical Decision (MALD) project [5]
 - Participants listened to audio recordings of a Western Canadian English speaker which differ in their proportion of unfamiliar phonemes
 - Participants decided whether recordings were of an English word or a pseudoword (Table 2)
 - Responses were recorded with a button box

Analysis

- Response time used as a proxy for processing difficulty
- Measured effects of proportion of unfamiliar phonemes, proportion of unfamiliar vowels, and proportion of unfamiliar consonants on reaction time using statistical techniques (Table 1)
- Real words responded to correctly were analyzed
- Reaction times longer than 500ms were analyzed

IPA	Sample Word	Mandarin Alternative(s)
ɪ	dip	i
æ	cat	an
ʊ	book	u
ɛ	net	ei
v	van	f or w
z	zoo	ts
ʒ	measure	ʃ or ts
θ	thin	s
ð	the	ts
dʒ	jam	ts or ʃ

Table 1. English phonemes absent from Mandarin and possible Mandarin alternatives (vary with dialectal differences) [1,3,4,6]

Sample Phonemes	Word	Pseudoword
negative	negative	muhbaend
negativ	negativ	muhbænd

Table 2. Sample MALD word and pseudoword with unfamiliar phonemes

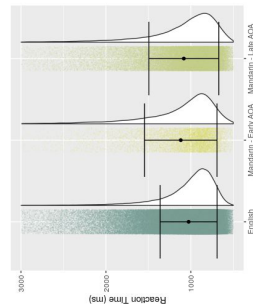


Figure 1. Mean reaction times by AoA group

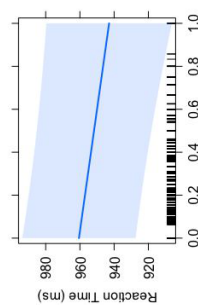


Figure 2. Effect plot of proportion of all unfamiliar phonemes on reaction time

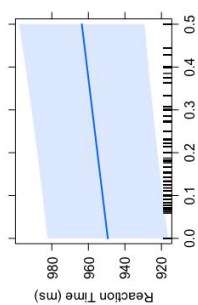


Figure 3. Effect plot of proportion of unfamiliar vowels on reaction time

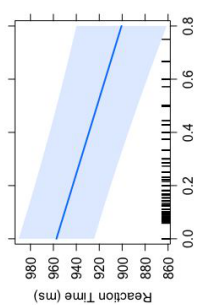


Figure 4. Effect plot of proportion of unfamiliar consonants on reaction time

3. Results

Overall (Figure 1):

- Reaction time of native Mandarin speakers is slower and more variable than native English speakers
- Age of acquisition and self-rated English proficiency do not have a significant effect on response time

Unfamiliar phonemes

- **All** (Figure 2): proportion of all unfamiliar phonemes has no significant effect on reaction time (t -value of -1.639)
- **Vowels** (Figure 3): greater proportion of unfamiliar vowels increases (slows down) reaction time (t -value of 2.408)
- **Consonants** (Figure 4): greater proportion of unfamiliar consonants decreases (speeds up) reaction time (t -value of -4.954)

4. Discussion

- Experiment was largely exploratory
- Limited effects of an unfamiliar phoneme may be because the closest Mandarin alternative does not occur in English, or the phoneme is different enough to be perceived as unlike any known phonemes, therefore difficulties are limited to speech production and not perception
- Age of acquisition and English proficiency may not be accurate as they are not discrete, objective measurements
- Mandarin English L2 speakers process English similarly to native English speakers

References:

[1] Catford, J. C., Palmer, J. D., Dew, J. E., Barry, R. G., Cheng, H. L., Hsu, V. L., & Li, Y. (1974). Phonology: The sounds of English and Chinese. In *A Contrastive Study of English and Mandarin Chinese* (pp. 3-34). Presidio of Monterey, Defense Language Institute.

[2] Hsu, V. L., & Li, Y. (2009). The effects of L2 phonology on L2 language learning and bilingualism. In *The Routledge Handbook of Phonetics* (pp. 427-447). Routledge.

[3] Jia, G., Strange, W., Wu, Y., Colado, J., & Guan, Q. (2006). Perception and production of English vowels by Mandarin speakers: Age-related differences vary with amount of L2 exposure. *The Journal of the Acoustical Society of America*, 119(2), 1118.

[4] Li, S., & Wang, L. (2012). Cross linguistic comparison of Mandarin and English EMA articulatory data. In *Proc. Annu. Conf. Int. Speech Commun. Assoc.* (pp. 903-906).

[5] Tucker, B. V., Brenner, D., Danielson, D. K., Kelley, M. C., Nenadic, F., & Sims, M. (2018). The Massive Auditory Lexical Decision (MALD) database. *Behavior Research Methods*, 51(3), 1187-1204.

[6] Wu, C., & Shin, C. (2009). Mandarin Vowels Revisited: Evidence from Electromagnetic Articulography. *Annual Meeting of the Berkeley Linguistics Society*, 35(1), 328-340.

Acknowledgments: Thank you to sponsoring me and to WISEST for this opportunity. Thank you to Dr. Tucker for the data. Thank you to the Alberta Phonetics Laboratory who helped with the project or taught me about linguistics, especially Scott Perry, Matthew Kelley, Kristen Mulder, and Svy Chen. Finally, thank you to my teachers at St. Basil in the Sw. JPII Program and Mother Margaret Mary for inspiring and encouraging me (and to my family, as always).

Contact: gmbholko@gmail.com, bvtucker@ualberta.ca

