

MANDARIN SPEAKERS' PRODUCTION OF ENGLISH VOWELS IN REAL AND PSEUDO WORDS

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1. INTRODUCTION

Some theoretical perspectives, such as Flege's (1995) Speech Learning Model (SLM) see second language (L2) phonetic learning as a gradual, approximative process whereby learners' productions of at least some L2 segments improve as a function of L2 experience. Empirical support for this view comes from longitudinal investigations, such as Munro & Derwing (2008), who observed that Mandarin speakers produced more intelligible exemplars of some, but not all, English vowels after a year of residence in Canada. An additional outcome of that study was that bVC words had more intelligible vowels overall than did pVC words. However, because the voicing of the initial consonant was confounded with word frequency in their stimulus set and only a limited range of contexts were used, it was not possible to determine whether the intelligibility difference was due to the voicing status of the initial consonant, to word frequency, or to some other influence.

The current study extends Munro and Derwing's (2008) work by unconfounding some of these factors. It examines Mandarin speakers' productions of three English vowels in real and pseudo words. Vowels in pseudo words differing only in the voicing of the initial consonant will be assessed to address the first research question: Does the voicing status of the initial consonant in CVC(C) words influence the intelligibility of the following vowel? Because only pseudo words will be used, the potential effects of word frequency are eliminated. Second, vowel intelligibility in English words varying in initial and final consonants will be compared for words varying in frequency to answer the second research question: Does word frequency influence vowel intelligibility in CVC(C) words? A third question to be addressed is as follows: Is greater L2 experience, assessed in terms of length of residence (LOR) in Canada, associated with greater vowel intelligibility?

2. METHOD

2.1 Participants

Eight native Mandarin speakers, 3 males and 5 females, ranging in age from 22 to 32 ($M = 25$), participated in this study. The subjects started to learn English at age 7 to 14 years in school and had been in Canada for a mean of 2.4 years (range = 4 months to 6 years). Among them, four had one year or less of residence in Canada. None of them reported any previous pronunciation training or hearing/speech impairment.

2.2 Stimuli

The stimuli were produced in CVC(C) structures containing one of the three target vowels /ɪ/, /ʊ/ and /ʌ/ which are non-native to Mandarin speakers. In total 56 words (see Appendix 1) were paired such that they differed from each other by onset voicing, rhyme and word frequency. These words were arranged into three stimulus sets. Set 1 ('all pseudo') contains paired pseudo words differing in onset voicing. Set 2 ('pseudo/low frequency')

consists of pseudo words or low frequency words which differed from the low frequency or high frequency words in set 3 ('low/high frequency'). We utilized the Michigan Corpus of Academic Spoken English (MICASE) to determine the frequencies of the real words.

2.3 Speaking task

Participants produced the target words in a delayed repetition task. They were required to repeat the target word three times in the frame "The next word is ____." The model stimuli were spoken by a male native speaker of Canadian English in a different form "Now I say ____." The best tokens were digitally extracted and normalized, using Sound Forge 6.0. Those tokens with recording errors, background noise and speakers' errors were avoided.

2.4 Classification task

All 56 words were replicated twice, resulting in 960 tokens ($60 \text{ words} \times 8 \text{ participants} \times 2 \text{ repetitions}$). All tokens were randomized and grouped into four blocks using E-prime and then presented to a phonetically-trained native speaker of Canadian English, who identified the English vowel category closest to each pronunciation.

3. RESULTS

3.1 Onset voicing

The effect of onset voicing was examined for all pseudo words. A one-way repeated measures analysis of variance (ANOVA) revealed no significant effect of initial consonant voicing on vowel target accuracy [$F(1, 7) = .077, p = .789$] (see Fig. 1).

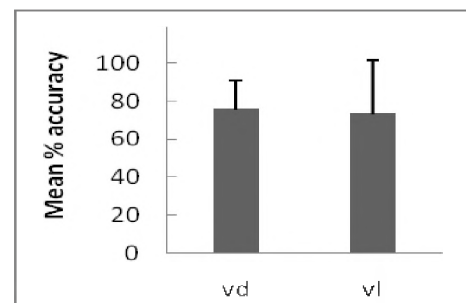


Fig.1. Mean %-ID of vowel targets for 'all pseudo' words with voiced (vd) onsets and those with voiceless (vl) onsets.

3.2 Vowel and word frequency

Effects of vowel and word frequency were measured for 'pseudo/low frequency' and 'low/high frequency' words. A two-way repeated measures ANOVA with vowel and word frequency as within-subject factors indicated a significant effect of vowel [$F(2, 14) = 13.449, p = .001$] but no significant effect of word frequency [$F(1, 7) = 2.294, p$

= .174]. Nevertheless, there was a tendency for mean correct identification to be higher for the high frequency items than for the pseudo or low frequency words. The interaction of vowel x frequency was also found to be non-significant [$F(2, 14) = .920, p = .421$]. Post hoc Bonferroni tests also revealed a significant difference between the identification of /ʌ/ and that of /ʊ/ and /ɪ/ ($p = .005$ and $.039$, respectively) (see Fig.2).

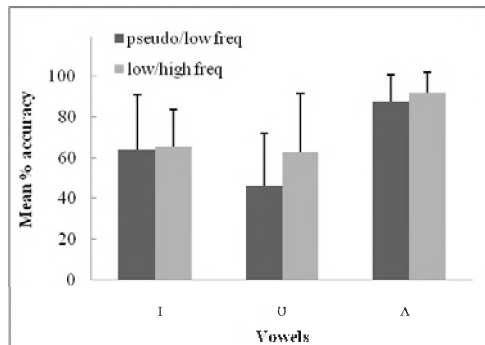


Fig.2. Mean %-ID of /ɪ/, /ʊ/ and /ʌ/ in ‘pseudo/low frequency’ and ‘low/high frequency’ words.

3.3 LOR

To answer the third research question, a two-way repeated measures ANOVA was carried out to compare the mean correct identification of /ɪ/, /ʊ/ and /ʌ/ produced by speakers with longer length of residence (LOR-L, LOR = 1.5 to 6 yrs) and those with shorter length of residence (LOR-S, LOR = 0 to 1yr). A significant effect of LOR was found across all three stimulus sets [$F(1, 6) = 9.98, p = .02$], indicating higher scores for the longer residents (see Table 1). A significant effect of stimulus set was not observed [$F(2, 120) = .38, p = .692$]. There was also no significant interaction between stimulus set and LOR, indicating that the effect of LOR was comparable for all three stimulus sets. Nevertheless, as shown in Table 1, there was a non-significant trend for the shorter-term residents to score better on the higher frequency words (62% vs. 70%).

Table 1. Mean %-ID (M) and standard deviation (SD) by Mandarin speakers with longer LOR (LOR-L) and shorter LOR (LOR-S).

	All pseudo		Pseudo/low freq		Low/high freq	
	M	SD	M	(SD)	M	(SD)
LOR-S	62	(19)	62	(20)	70	(11)
LOR-L	88	(7)	83	(6)	84	(6)

3.4 Rhyme

A one-way ANOVA was also conducted to examine whether rhyme had any effect on vowel target accuracy. A statistically significant effect of rhyme was observed across stimulus sets 2 (‘pseudo/low frequency’) and 3 (‘low/high frequency’) [$F(17, 119) = 11.666, p < .0001$]. Among all 18 rhymes, /ʊ/ preceding consonant /l/ was identified with the lowest accuracy (9%, compared to the highest score of 97% for vowel /ʌ/ followed by /z/).

4. DISCUSSION

The results of this study provide some insights into the issues raised in the three research questions. First, the voicing status of the initial consonant had no effect on the vowel target accuracy in CVC(C) words, at least in pseudo words. Secondly, word frequency did not appear to affect vowel intelligibility. Nevertheless, a non-significant tendency was observed in this study from two perspectives. The first trend was that the identification of vowels in common words with higher frequency tended to be higher than in those with lower frequency. The second is that the shorter-term L2 learners tended to have better performance when producing the vowels in the words with higher frequency. Because of the small number of participants in this investigation and the limited number of productions considered, it is not possible to draw firm conclusions about the role of word frequency in vowel production. However, the latter tendency is at least consistent with the view that longer-term residence in the target language country improves vowel intelligibility in a significant way. In addition, the results of this study also indicate that final consonants play a role in the identification of the preceding vowel in L2 speakers’ productions. Given the wide variety of factors affecting vowel intelligibility, further research is needed to clarify the interplay of the many possible influences.

APPENDIX 1.

Stimulus Set	Phonetic Representation of Stimulus Words
Set 1	bɪm-pɪm, bɪʃ-pɪʃ, bʊd-pʊd, bʊdʒ-pʊdʒ, ʃɪʃ-ʃɪʃ, ʃʌd-ʃʌd, ʃʌf-ʃʌf, ʃʌz-ʃʌz
Set 2	pɪd, bɪk, bɪm, pɪz, pʊk, bʊl, bʊt, bʌb, bʌp, pʌst, pʌz, ʃɪk, ʃɪm, ʃɪp, ʃɪst, ʃʌʃ, ʃʌk, ʃʌkl, ʃʌm, ʃʌst
Set 3	bɪd, pɪk, pɪm, bɪz, bʊk, pʊl, pʊt, pʌb, pʌp, bʌst, bʌz, ʃɪk, ʃɪm, ʃɪp, ʃɪst, ʃʌʃ, ʃʌk, ʃʌkl, ʃʌm, ʃʌst

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