English Vowel Production by Native Speakers of Beijing Mandarin

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Abstract: Ten isolated English vowels produced by 15 Beijing Mandarin speakers and 15 native English speakers were randomly presented to trained English listeners who identified them in a forced-choice task. The Mandarin-accented vowels without obvious Mandarin counterparts were significantly less intelligible than those with Mandarin counterparts. However, additional between-vowel effects were noted. Acoustic analyses revealed that most of the Mandarin speakers' vowels were strongly influenced by the Mandarin vowel system.

INTRODUCTION

This study was carried out to identify areas of difficulty experienced by native Beijing Mandarin (BM) speakers in producing English vowels. Although a number of surface vowels occur in BM, it can be viewed as having categories comparable to Canadian English (CE) [i ei u ou] but as lacking counterparts for CE [I e æ u o], at least as stressed monophthongs.

A variety of models have been proposed to predict difficult sounds for second language (L2) learners on the basis of the first language (L1) inventory, including Best's Perceptual Assimilation Model (1), Flege's Speech Learning Model (2) and the Contrastive Analysis Hypothesis (3). Rather than attempt to test any particular model, we examined speakers' productions in post-hoc fashion to determine the types of generalizations about L2 vowel production that might be possible. To overcome some of the limitations of previous work in this area we restricted the participants to a single dialect and compared L2 productions with productions from the learners' L1. Also, because most previous vowel identification tasks of this sort have involved vowels in consonantal context we decided to add to the available data by examining isolated vowel productions.

METHOD

The 15 native Mandarin speakers (8 female, 7 male) were born and raised in Beijing and had moved to Canada as adults. All were high-proficiency English speakers. Fifteen native speakers of Canadian English participated as a comparison group. Isolated productions of CE, Mandarin-accented English (ME), and BM vowels were collected through reading lists. The speakers read an English /bV/ word containing the target vowel followed by a /bV/ production and then an isolated /V/, all in the carrier sentence "Now I say __." The Mandarin speakers also read a comparable Chinese list with vowels in the falling tone in the sentence frame “Wu shuo __” /wuo shuo/. The isolated vowel productions were saved for presentation and acoustic analysis.

INTELLIGIBILITY TEST

Four phonetically-trained native CE listeners each identified 1500 English vowel tokens (5 randomizations x 10 vowels x 30 speakers). Separate blocks of front and back vowels were identified using IPA symbols attached to a keyboard. The available choices were [i I ei e æ o] for the front vowels and [u u oo o æ æ e] for the back vowels.

The intelligibility scores are presented in Figure 1 above. ANOVAs on the correct ID scores indicated that although the ME [i ei u oo æ] were as intelligible as the CE tokens, their [I e æ u o] were significantly less
intelligible. In general, then, ME productions of vowels lacking Mandarin counterparts were less intelligible than those having such counterparts. However, further analysis of the data revealed that this generalization was far too simplistic. For instance, notable inter-speaker effects were observed, with some speakers producing perfectly intelligible [e æ] and others producing virtually unintelligible exemplars of these vowels. Furthermore, among those vowels missing from the Mandarin inventory, inter-vowel effects occurred. The ME productions of [u], for example, were very poorly identified for all but one speaker, but more than half the speakers produced well-identified [æ] tokens. These findings suggest that an understanding of the difficulties involved in L2 vowel production requires not only a comparison of L1 and L2 inventories, but careful consideration of why some speakers perform much differently from others.

ACOUSTIC MEASUREMENTS

The CE, Mandarin-accented, and BM vowels were measured for duration and F1 and F2 frequencies. The formant values (at 30% of the distance into the vowel) were log mean transformed and are plotted in Figure 2 below.

![Figure 2](image-url)

**FIGURE 2.** Mean F1 & F2 (normalized values) plot of CE, ME, and BM vowels

The spectral comparisons between the ME and CE productions revealed significant differences in either F1, F2 or both for every vowel except [i e]. In some cases, the accented vowels tended to be “pulled” towards their Mandarin counterparts so that they fell between the English and Mandarin vowels in Figure 2. An examination of the individual ME tokens revealed extensive spectral overlap in [i]-[e], [e]-[æ], [u]-[o] pairs.

Judging from the strong similarities between the ME vowels and their BM counterparts, it appears that the Mandarin speakers simply made use of their Mandarin categories in producing the English vowels [i e u o]. For the vowels lacking Mandarin counterparts, spectral deviations or overlapping seemed to account for the reduced intelligibility in the identification experiment.

Taken together, the results of these two experiments suggest a strong influence of the L1 vowel system on L2 vowels, regardless of whether the vowels have L1 counterparts. They also illustrate some of the problems involved in attempting to generalize about the difficulties faced by speakers of a particular L1 in acquiring an L2 vowel system.

REFERENCES


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