A Longitudinal Examination of English Vowel Learning by Mandarin Speakers

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1. INTRODUCTION

Current models of second language (L2) speech learning were developed to account for various types of difficulties that L2 learners face in the acquisition of specific vowels and consonants. Flege's (1995) speech learning model (SLM), for example, proposes that accurate production of L2 phones ultimately depends on how well learners are able to distinguish them perceptually from similar L1 sounds. According to Major's (1996) Similarity Rate Differential Hypothesis (SDRH), phones dissimilar to L1 sounds are acquired more rapidly than those that are similar. However, a detailed evaluation of the relative difficulties presented by L2 sounds and of their rate of acquisition requires a wide range of data, including data collected at different times duirng L2 learning. Despite the large number of studies of L2 perception and production conducted in recent years, relatively few have examined the acquisition of categories by low-proficiency speakers from a longitudinal perspective. Most studies with a longitudinal component have considered only a limited range of speech sounds or have considered learners over a short period of time. This study addresses the gap in current research by evaluating a broad range of English vowel productions of recently-arrived Mandarin speakers during their first year in Canada.

Mandarin is usually described as having a system of five vowels : /i y u e a/. The English vowels /I U E/, which are missing from this inventory, are known to pose perceptual and production difficulties for Mandarin speakers (see Wang, 2002). We will pay particular attention to these vowels in the analyses of our results.

2. METHOD

2. 1 Participants

The participants were 20 native Mandarin speakers registered full-time in low-intermediate ESL classes at a local college. They ranged in age from 26-38 years (M = 33.4). None had been in Canada for longer than 4 months at the outset of the study. All passed a pure tone hearing screen. In their ESL program they received little or no explicit pronunciation training, and none received any training specifically on vowels.

2.2 Speaking Task

High-quality mini-disc recordings were made during individual sessions in a quiet room. The speakers heard a recorded voice producing the carrier frame, "The next word is ___" and responded by saying, "Now I say _____," completing the sentence with the stimulus items. The target words were /pVt/ and /bVt/ words, and nonsense syllables containing the vowels /i I e E Q u U o A ?/. Each speaker was recorded six times (T1 to T6) at intervals of approximately 8 weeks. Of 2400 possible items, 7 were missing because speakers occasionally failed to repeat a particular item or because of recording or editing errors.

2.3 Evaluation

The first two authors evaluated the remaining 2393 tokens in a forced choice randomized listening task in which they heard each word through headphones and identified the closest Canadian English vowel by pressing a labeled button on a computer screen. Items could be replayed up to four times, and a "none" category was available for items that appeared to match no native English category. Multiple blocks were presented over a period of days to reduce fatigue. The listeners had no idea of the time or the speaker of any particular item.

3. RESULTS

For each speaker, the total number of correct productions was tallied at each time. Means across all 20 speakers are shown in Figure 1.

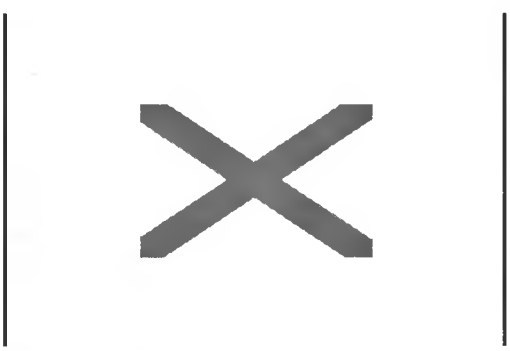

Fig. 1. Mean correct ID scores (%) pooled over speakers and vowels at each of the eight-week intervals.

A one-way repeated measures ANOVA on the ID scores with Time (6 levels) as the within-speakers factor yielded a significant effect of Time, $F(5, 95) = 7.66$, $p<.001$. A series of post hoc pairwise comparisons were computed, in which the scores at T1 were compared with the scores at each other time, with $p<.01$ (Bonferroni-adjusted) as the criterion for significance. The mean scores at T4, T5, and T6 were significantly higher than the score at T1, $t(19) = 3.56$, 5.26, and 4.00, respectively. The mean scores at T1 and T2 did not differ significantly; nor did the scores at T1 and T3.

Table 1 shows mean %ID scores on each vowel at T1 and T6, as well as net changes in identifications on each vowel. Despite a general trend toward more accurate productions from T1 to T6, performance on the individual vowels varied considerably.

Table 1. Scores on individual vowels (%)

Vowel	T1	T6	Net Change
A	41	71	30
I	19	47	28
e	65	90	25
Q	56	78	22
u	61	79	18
?	62	70	8
o	78	84	6
i	94	94	0
U	63	63	0
E	68	55	-13

The most dramatic improvements were seen with /A I e/. Of these, /I/, which has no counterpart in Mandarin, was the least accurately-produced vowel at T1 and, despite the improvement, remained so at T6. Throughout the study, incorrect productions of this vowel were overwhelmingly identified as tokens of /E/. Performance on /i U/ remained unchanged, but for /i/, performance was already at near-ceiling levels at T1. Although /U/, the back counterpart of /I/, also does not occur in Mandarin, performance on /U/ appeared to be considerably better overall. The one vowel on which the speakers appeared to show an overall decline in performance was /E/.

4.0 DISCUSSION

These results raise a number of interesting issues concerning Mandarin speakers' learning of English vowels over a 1-year period. While it is possible that some of the overall improvement observed here was due to practice or to speaker familiarity with the task, there are at least two reasons for doubting that such factors had a major effect on the outcome: (1) Such factors would most likely be strongest during the early weeks of the study, not in the later weeks, as the statistical analyses showed, and (2) the effects of such factors should be fairly uniform across all vowels, rather than differential as observed here.

The vowel /I/, at least in the contexts used here, seemed to pose particular difficulty for the learners. Although their performance on this vowel improved immensely, it was the least accurately-produced vowel throughout the study. Further work is needed to determine whether the lack of a parallel pattern of difficulty and improvement for /U/ was due to different patterns of perceptual assimilation for the two vowels.

The paradoxical decrease in the speakers' scores on /E/ is also worthy of further examination. Cebrian (2002) concluded that L2 vowel acquisition must be considered in a systemic way, rather than exclusively in terms of individual category acquisition. It should be noted that /E/ is regarded as an allophonic variant of Mandarin /e/. At the outset of the study the speakers may have been able to take advantage of their knowledge of Mandarin vowel categories in order to produce fairly accurate tokens of this vowel. Although we cannot be certain of the reasons for the decline in performance on /E/, it is interesting to note that this decline coincided with improvement on two nearby front vowels (/I/ and /Q/). This suggests that, over the course of the study, the speakers may have been adjusting their perceptual representations of front vowel categories to accommodate the new vowels.

REFERENCES

Cebrian, J. (2002). *Phonetic similarity, syllabification, and phonotactic constraints in the acquisition of a second language contrast.* Unpublished PhD dissertation, Dept. of Linguistics, University of Toronto.

Flege, J. E. (1995). Second-language speech learning: Theory, findings, and problems. In W. Strange (Ed.), *Speech perception and linguistic experience: Theoretical and methodological issues.* Timonium, MD: York Press.

Major, R. C., & Kim, E. (1996). The similarity differential rate hypothesis. *Language Learning, 46,* 465-496.

Wang, X. (2002). *Training Mandarin and Cantonese speakers to identify English vowel contrasts: Long-term retention and effects on production.* Unpublished PhD dissertation, Dept. of Linguistics, Simon Fraser University.

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