

A longitudinal study on vowel development of a Mandarin-English bilingual child

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INTRODUCTION

The purpose of the present study is to examine how a sequential bilingual child develops the vowel system in L2 and how the vowel systems in both L1 and L2 change during a one-year period.

BACKGROUND

•Davis and MacNeilage (1990) examined children's vowel acquisition from 14 to 20 months and found that /i u/ were produced with high accuracy rate and /e ɔ/ were produced with low accuracy rate.

•Otomo & Stoel-Gammon (1992) examined English children's acquisition of unrounded vowels /i e æ a/ and found that /i a/ were acquired earlier with higher pronunciation accuracy than /e/.
To date, few studies have systematically examined bilingual children's acquisition of L2 vowel system in terms of the acoustic features and locations of individual vowels in the acoustic space.

•Meanwhile, numerous studies have demonstrated that early bilinguals demonstrate bi-directional interaction effects between L1 and L2. (Guion, 2003, Baker & Trofimovich, 2005, Oh et al., 2011).

However, few studies examined how the L1 and L2 dynamically interact with each other during the process of L2 acquisition in sequential bilingual children.

BASIC RESEARCH QUESTIONS:

1. How does the English acoustic vowel space (in terms of vowel locations and area) change across the 12-month period in the sequential bilingual child?
2. Does the Mandarin acoustic vowel space change after prolonged experience with English (an effect of L2 interactions with L1)?

METHODS

SPEAKER

- One native Mandarin-speaking boy born and raised in the US.
- Exposed to a Mandarin-dominant environment until he enrolled in a preschool program when he was about 3½ year old.

MATERIALS

- 7 Mandarin vowels /i y a u o ɤ ʌ/ and 12 English vowels /i i e e æ u u o o ɔ ɔ ɔ ɔ ɔ ɔ/ presented in picturable words.
- Consonant environment not controlled for either Mandarin or English.
- Tone environment not controlled for Mandarin.

PROCEDURE

- This longitudinal study lasted for a 12-month period with one recording session taking place each month.
- The first recording session was completed two weeks after the boy first enrolled in the preschool program at the age of 3;6.
- Each recording session included two parts: production of Mandarin and production of English tokens; sessions were separated by a 15-20 min break.

ACOUSTIC MEASUREMENTS

- F1 and F2 were measured using extra wideband (600 Hz) spectrography at three equidistant temporal locations (the 35%, 50% and 65% points).
- The mean values of F1, F2 at these three locations across multiple tokens for each vowel within two-month periods were used to plot the vowel space.

SUMMARY

- The child's English acoustic vowel space gradually changed from a Mandarin-like triangular shape to a typical English-like quadrilateral shape.
- In the first stage of acquisition, the child merged /i/ and /i/ to the same vowel category as well as /u/ and /u/, /e/ and /æ/, /ɔ/ and /ɔ/.
- As his experience with English increased, the child established English vowels categories with the order of /u/ > /u/ > /i/ > /e/ > /æ/ > /ɔ/.
- English /u/ was initial similar to the backed Mandarin /u/, was later assimilated to the very fronted Mandarin /y/ and finally formed a typical English /u/. This revealed the strong influence of L1 to L2.
- The child's Mandarin acoustic vowel space steadily decrease in size with the backward movement of /i/ and upward movement of /u/. But the general shape of Mandarin vowel space did not show significant change over the one year period.
- No results were obtained that demonstrated the influence of L2 on L1.

REFERENCES:

Baker, W., & Trofimovich, P. (2005). Interaction of native and second-language vowel systems in early and late bilinguals. *Language and Speech*, 48 (1), 1-27.
Davis, B. L., & MacNeilage, P. F. (1990). Acquisition of correct vowel production: A quantitative case study. *Journal of Speech and Hearing Research*, 33, 16-27.
Guion, S. G. (2003). The vowel systems of Quichua-Spanish bilinguals. *Phonetica*, 60, 98-128.
Otomo, K., & Stoel-Gammon, C. (1992). The acquisition of unrounded vowels in English. *Journal of Speech and Hearing Research*, 35, 604-616.
Oh, G., Guion-Anderson, S., Aoyama, K., Flege, J. E., Akahane-Yamada, R., & Yamada, T. (2011). A one-year longitudinal study of English and Japanese vowel production by Japanese adults and children in an English-speaking setting. *Journal of Phonetics*, 39, 156-167.

Organization of vowel systems

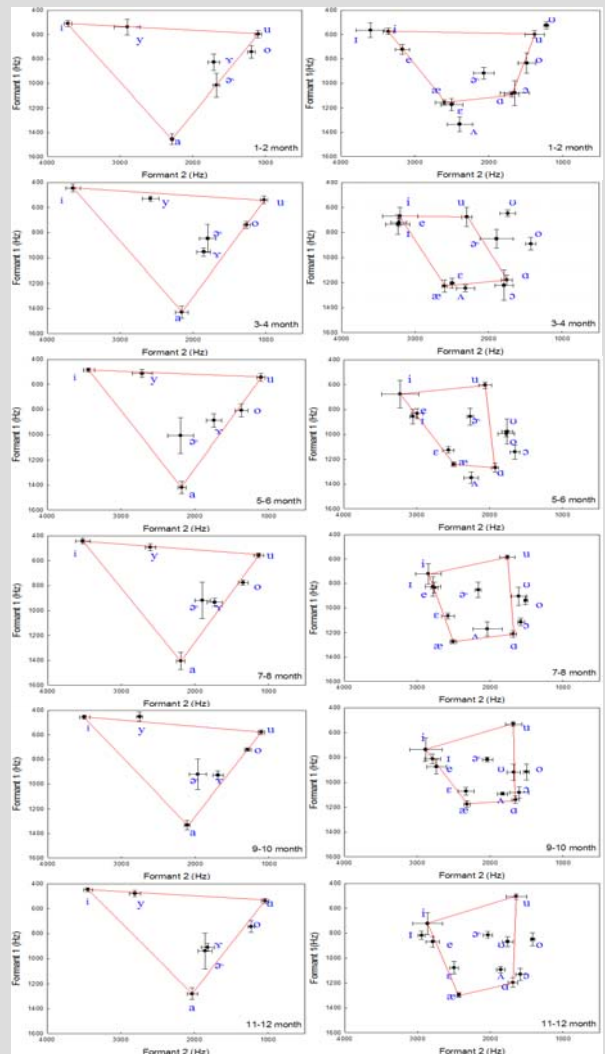


Figure 1. Development of vowel system and the relative position of individual vowels in acoustic vowel space across 12-month period in Mandarin (left) and English (right)

Changes in acoustic vowel spaces

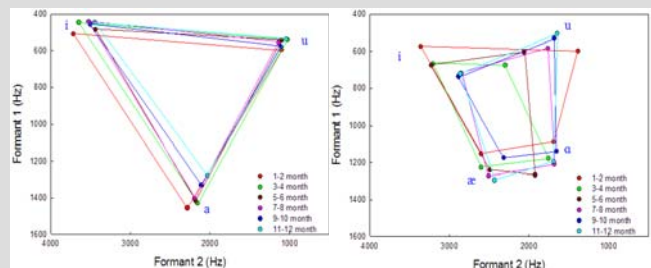


Figure 2. Change of vowel space area across 12-month period in Mandarin (left) and English (right)

Table1. change of acoustic vowel space area across 12-month period (kHz²)

	Mandarin	English
1-2 month	1.175	0.777
3-4 month	1.218	0.477
5-6 month	1.051	0.542
7-8 month	1.074	0.584
9-10 month	0.963	0.525
11-12 month	0.936	0.650