

Acquisition of variation in dual immersion preschools: the use of syllable-initial alveolar and retroflex sibilants by Chinese heritage language children

Yi Zhang¹ Xinye Zhang² Hai Hu¹ Aini Li¹

¹*City University of Hong Kong*

²*University of California, Davis*

The acquisition of native-like patterns of variation is an integral part of language learning [1, 2]. While prior research has examined how factors such as input, age, gender, language background, and discourse context influence this process [e.g., 3, 4], less is known about how young emergent bilingual children acquire sociophonetic distinctions in a heritage language setting. To address this gap, this study investigates the acquisition of Mandarin sibilant variation—specifically, the distinction between alveolar and retroflex initials—in the production of Chinese heritage language children attending dual immersion preschools. In particular, we examine whether these children differentiate the two categories, whether their accuracy improves with age, and how their production may be influenced by factors such as family language background, gender, language ability, and communicative context.

A total of 27 Chinese heritage language children (14 boys, 13 girls, aged 3;01 - 5;04) were recruited from two dual English-Mandarin immersion preschools. Spontaneous speech data were collected at the beginning of the semester and the end of the semester (six-month interval) through audio recordings during a language assessment session, which included two standardized tests (the Mandarin Peabody Picture Vocabulary Test and the Woodcock-Johnson IV Test of English oral language and phonological awareness), a sociolinguistic interview, and a storytelling task. Family background information was obtained via a parental questionnaire. A total of 11,231 target sibilant tokens were phonetically annotated and acoustically analyzed in Praat, with fricative duration and center of gravity (COG) measured for each token. To examine the realization of these sibilants, two mixed linear regression models were fitted with duration and COG as the dependent variables. The primary predictor was tongue position (alveolar vs. retroflex), which was interacted with a set of covariates: target consonant groups (fricatives, unaspirated affricates, or aspirated affricates), test time (the start vs. the end of the semester), language proficiency scores, home language environment, gender, age, and production task. Both models included participant and lexical word as random intercepts.

Findings show that overall, COG serves as a reliable acoustic cue (**Fig.1**) for distinguishing sibilants in children's production, whereas fricative duration does not (**Fig. 2**). Crucially, as shown in **Fig. 1**, significant COG differences were observed only for fricatives (/s/ and /ʃ/) ($\beta = 857.1, p < 0.001$), indicating that this contrast is overall better learned and maintained compared to affricates. Moreover, COG differences were significantly influenced by several factors: they increased significantly over time, as indicated by a main effect of test time ($\beta = 580, p < 0.001$). These differences were also more pronounced among children from non-Taiwanese family backgrounds ($\beta = 842, p < 0.001$) and among boys ($\beta = 607, p < 0.001$). Furthermore, COG differences were significantly greater in conversation ($\beta = 347, p = 0.03$) and storytelling ($\beta = 618, p < 0.001$), compared to formal testing. Finally, children's age and language proficiency scores in both Mandarin and English were significantly associated with variations observed in COG and duration, pointing to a possible phonetic transfer between the two languages [5,6,7].

In short, this study investigates the development of the alveolar-retroflex sibilant contrasts in young heritage Mandarin speakers, revealing how this process is shaped by both linguistic and social factors. By extending the scope of variation acquisition research to linguistically diverse Chinese heritage communities, this study contributes to our current understanding of how sociolinguistic variation is learned. The results align with language socialization perspectives, suggesting that children in this age group actively explore and adapt linguistic patterns through interaction within their social networks [8, 9, 10].

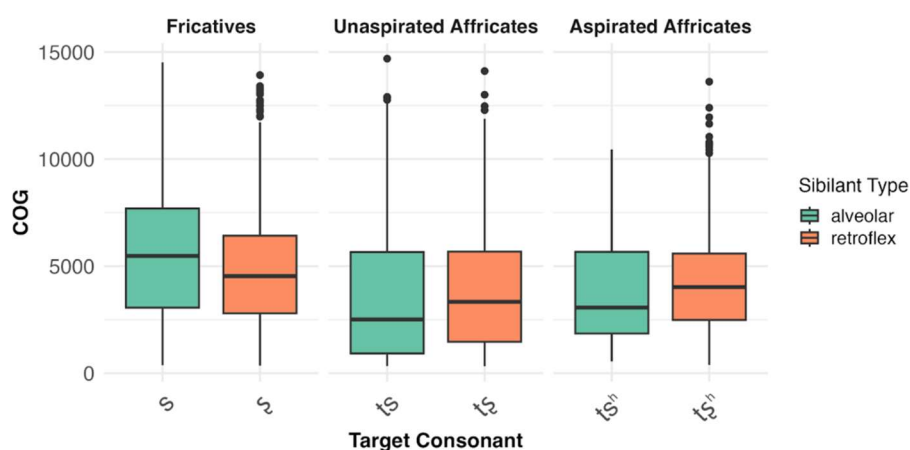


Fig. 1. Difference in COG for different consonants

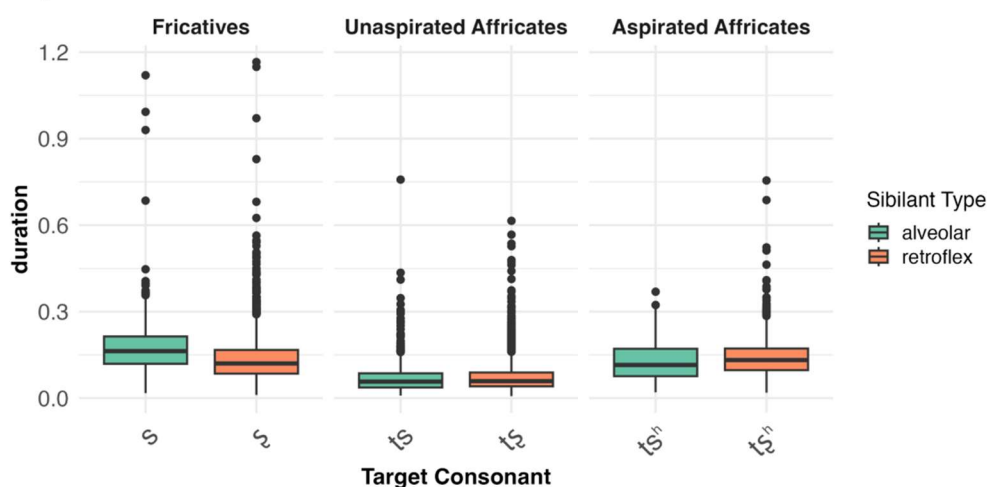


Fig. 2. Differences in fricative duration (in seconds) for different consonants

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