Extending the Articulatory Map model to account for token-to-token variability in bilingual children acquiring Jamaican Creole and English

The Articulatory Map (A-map) model is a recently proposed framework to account for patterns in the development of speech sound production in monolingual children (McAllister Byun, Inkelas, & Rose, 2016). The model proposes that child speech is shaped by competing forces of *accuracy* (pressure to approximate an acoustic target modeled in the environment) and *precision* (pressure to use a speech-motor routine stabilized through extensive practice). Different relative weightings of the associated constraints ACCURATE and PRECISE can account for distinct profiles in speech development described as "exploratory-variable" and "systematic-stable" (Vihman & Greenlee, 1987). One limitation of the A-map model is that the constraint ACCURATE is calculated in terms of distances between measures of central tendency of child and adult exemplar clouds in acoustic space. It therefore does not factor in the amount of variability in the child's input when estimating the pressure to conform to the adult target. We argue that this approximation may suffice to capture monolingual development, but for bilingual development, it may be necessary to extend the model to reflect the degree of dispersion in the child's input. This is because bilingual input can have intrinsically higher variability, particularly when the two languages share many cognate words (Bosch & Ramon-Casas, 2011). As a test case, we examine bilingual acquisition of Jamaican Creole (JC) and its lexifier language, English.

This study compares repeated utterances elicited from monolingual English-acquiring children in a previous published study (Macrae & Sosa, 2015) versus bilingual children acquiring English and JC from Kingston, Jamaica. Sixteen JC-English bilingual children aged 3-5 were recorded producing 25 items in three repetitions in both languages. Items were drawn from a standardized measure (Dodd et al., 2009) previously used to quantify token-to-token variability in monolingual English-acquiring children (Holm, Crosbie, & Dodd, 2007; Macrae & Sosa, 2015). Following procedures from previous literature, children's productions in each language will be phonemically transcribed and classified as consistent (same broad transcription across repetitions) or variable. The percentage of tokens produced variably has been shown to correlate with the robustness of phonological representations (Macrae & Sosa, 2015). We hypothesize that bilingual children will show greater token-to-token variability than monolingual children matched for approximate vocabulary size.

Pilot data collected from 9 JC-English bilingual children from New York suggests greater variability in bilingual children's productions in JC compared to English (Figure 1). Unfortunately, comparisons of the pilot sample against our target monolingual sample from Macrae & Sosa (2015) were compromised by differences in age and in the procedure of administration of the repeated production protocol (consecutive versus spaced elicitation of the tokens). For this reason, the current study collected data from a larger and better-matched sample of bilingual children using the same elicitation procedure as Macrae & Sosa (2015). Although data collection has been completed, analysis is still ongoing.

If our hypothesis of greater variability in bilingual versus monolingual children is supported, this result could be construed as evidence that bilingual speech development can be partly but not fully accounted for by the A-map model (Stoehr, 2018). In particular, the constraint ACCURATE may need to be extended to reflect the variability as well as the mean location of the adult target. If bilinguals do not differ from monolinguals in average variability, we will further test for an influence of relative exposure to JC versus English. If differences in token-to-token variability track the percentage of exposure to that language, this would suggest that stability is proportional to experience in producing a given language, in which case the current A-map model may suffice as a representation of bilingual development.

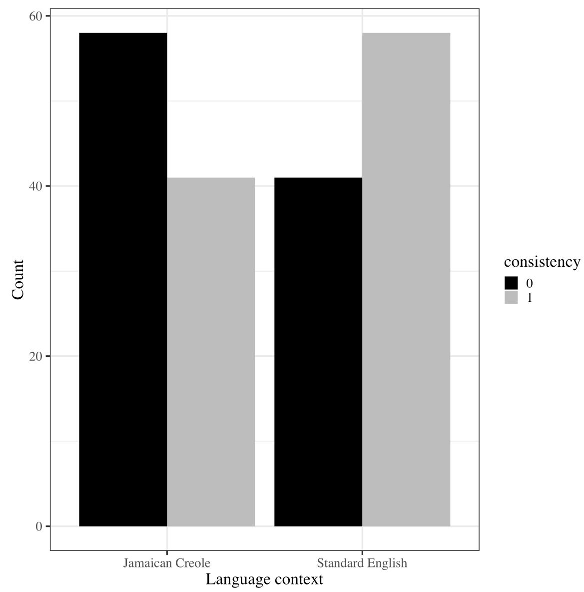

Figure 1. Consistency across language contexts for bilingual children (n = 9) from the NYC pilot sample. The y-axis represents the number of tokens scored as consistent versus inconsistent, and the x-axis represents the two language contexts (Jamaican Creole on the left and English on the right).

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