

Crosslinguistic influence in stop voicing arises from aerodynamic control: evidence from early multilinguals in Malaysia

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BACKGROUND It is well established that aerodynamic factors are crucial to the articulation of laryngeal contrasts [1, 2]. In this project, we examine the aerodynamic timing and control in stop voicing among multilingual speakers, which remains understudied despite stop voicing being an active area of research in multilingualism [3, 4]. We investigate this among early multilinguals in Malaysia, a contact site of Malay (true voicing), Malaysian English (variable voicing), and Mandarin (non-voicing). Speakers differ in dominance and linguistic repertoire but most are highly proficient in at least Malay and Malaysian English. Using aerodynamic and electroglottography (EGG) data from these speakers, we ask i) What are the aerodynamic mechanisms behind *initiating*, *sustaining*, and *inhibiting* voicing, and ii) Do these mechanisms differ by *language dominance* among early multilinguals?

METHOD The overall dataset comes from 22 L1 Malay, Malay-English bilinguals and 22 L1 Mandarin, Mandarin-Malay-English trilinguals. It contains Malay and English /b, p, m/ and Mandarin /p, p^h, m/ in three positions: *phrase-initial* (bargain is a correct word), *phrase-medial* (please say bargain again), and *word internal* (please say rebate again). Here, we report initial findings of Malay and Mandarin from female speakers: 8 x L1 Malay and 8 x L1 Mandarin, consisting an overall of tokens. For each token, we examine i) intraoral pressure trajectory during the stop closure (Fig. 1), ii) voicing amplitude trajectory from EGG (Fig. 2), and iii) voicing length (Fig. 3).

RESULTS 1 We first examined laryngeal contrasts in the dominant language of each group – Malay for the L1 Malay group, and Mandarin for the L1 Mandarin group. We find that the *timing* and *rate* of pressure changes play a key role in manipulating voicing: pressure is lowered to initiate or sustain voicing, but it is also increased to inhibit voicing. To *initiate* (phrase-initial Malay /b/) and *sustain* (intervocalic Malay /b/) voicing, pressure rises slower and later to facilitate vocal fold vibration. Voicing does not cease but decreases in amplitude as pressure increases. To *inhibit* voicing (intervocalic Malay /p/, Mandarin /p, p^h/), pressure rises sharply and peaks early around 30-40% of the closure. While pressure rises, voicing drops sharply in amplitude and completely ceases also at the 30-40% mark. After voicing ceases, pressure remains high but constant until the release.

RESULTS 2 To examine the effects of *dominance* on these mechanisms, we compared the Malay data between the L1 Malay and L1 Mandarin groups. We find that L1 Mandarin speakers show crosslinguistic influence (CLI) in *initiating* voicing for phrase-initial Malay /b/: L1 Mandarin speakers were less consistent than L1 Malay speakers at lowering pressure during the consonant closure, and this corresponded with more devoiced and partially voiced tokens of initial /b/ (Fig. 3). Interestingly, even after excluding /b/ tokens that were voiceless or partially voiced (<90% voicing) from the analysis, L1 Malay speakers still showed lower pressure than L1 Mandarin speakers (GAMMs; $\beta=-0.2$, $t=-4.4$, $p<.0001$), showing that CLI effects persist even when similar voicing targets are achieved. No differences in pressure between groups were found in *sustaining* voicing for /b/ and in *inhibiting* voicing for /p/.

CONCLUSION These findings show that language dominance and background play a role in shaping aerodynamic timing and control in speech, even among early multilinguals. The fact that L1 Mandarin speakers are more consistent at *sustaining* rather than *initiating* voicing in Malay also suggest that specific articulatory environments (e.g. intervocalic voicing) can be leveraged on when acquiring novel sounds in a non-dominant language. On a broader scale, these results also point to implications for how aerodynamic constraints may contribute to sound change in multilingual contact settings, reinforcing the role of aerodynamic factors in shaping phonological outcomes [cf. 5].

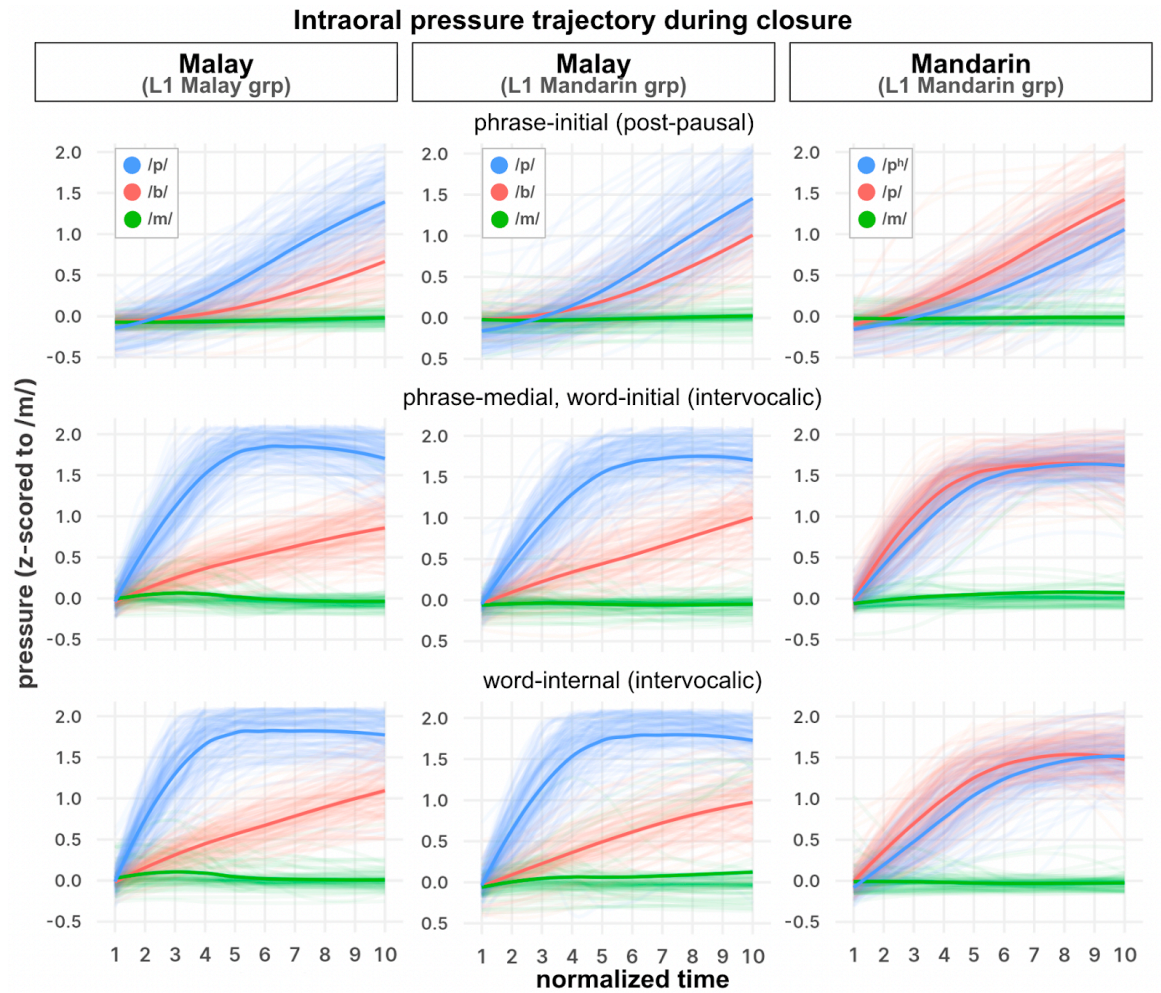


Figure 1. Intraoral pressure trajectory during closure. All values z-scored relative to the mean of /m/ for each speaker. Data from Malay /b/ includes only fully voiced tokens.

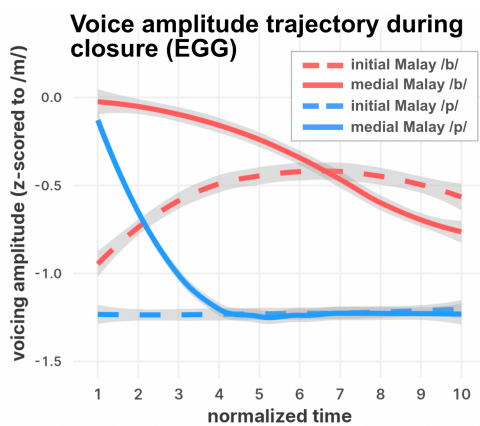


Figure 2. Voice amplitude trajectory of Malay initial and medial /b, p/ from the L1 Malay group. All values z-scored to the mean of /m/.

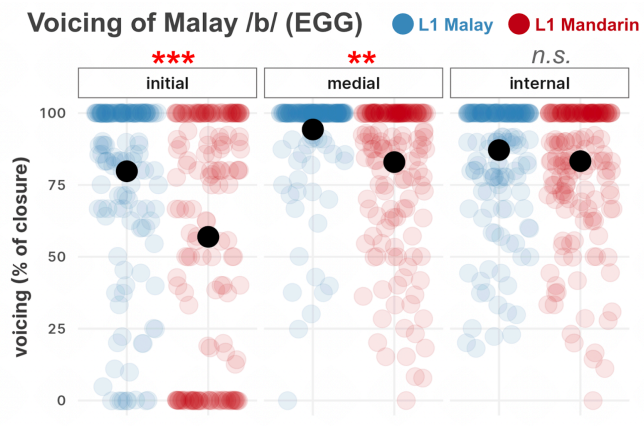


Figure 3. Voicing of Malay /b/ by group. Significance shows *emmeans* pairwise comparisons between group in each position: *** = $p < .001$, ** = $p < .01$, * = $p < .05$.

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