An ultrasound study of postvocalic stops in American English and Seoul Korean

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Background. In American English (henceforth English), /b d g/ are often phonetically voiceless, especially in utterance-initial position (Lisker & Abramson 1984; Keating 1984). In Seoul Korean (henceforth Korean), which lacks phonologically voiced stops, lenis stops /p t k/ are spontaneously voiced in intervocalic contexts (Jun 1998). One common articulatory adjustment to facilitate voicing during stop closure is tongue root advancement (e.g., Westbury 1983). However, in English, /b d g/ in utterance-initial positions that may not necessarily be phonetically voiced show tongue root advancement (Ahn 2018), suggesting that tongue root advancement may be more relevant to phonological voicing than phonetically motivated. This study aims to verify this claim, tongue root advancement is related to phonological voicing, by comparing sentence-medial postvocalic alveolar stops in English and Korean, using ultrasound tongue imaging. We hypothesize that acoustic voicing would not predict the tongue root advancement in English /d/ or Korean /t/, and that, English /d/, but not Korean /t/ that is phonetically realized as [d], would show tongue root advancement.

Method. Eight speakers of English recorded producing words beginning with /t/ and /d/ in sentence-medial post-vowel position (V#_V). Twelve Korean speakers produced /t th t*/ in sentence-medial word-initial post-vowel contexts (V#_V) and in word-medial intervocalic contexts (V_V). We examined mid-sagittal tongue contours immediately before the stop releases using SSANOVA (Gu 2002; Davidson 2006). Acoustic signals were examined to verify the presence/absence of voicing during stop closure.

Results. Ultrasound images show that in English, a distinction in tongue root position exists between /t/ and /d/ in post-vowel context (*Figure 1, left).* Acoustically, English /d/ is voiced intervocalically. Korean, on the other hand, does not show any consistent patterns across 12 speakers, both in word-initial and word-medial postvocalic positions (*Figure 1, right*), even when the lax /t/ is acoustically voiced.

Discussion. English speakers show tongue root advancement for /d/ in post-vocalic positions. Moreover, both English /d/ and Korean /t/ show acoustic voicing in post-vocalic positions, but only English /d/ exhibits tongue root advancement. These findings suggest that the tongue root advancement is an articulatory correlate of phonological voicing rather than vocal fold vibration. The lack of tongue root advancement in Korean /t/→[d] reinforces that tongue root advancement observed in English /d/ may not be phonetically motivated, corroborating Ahn's (2018) findings on English utterance-initial stops.We claim that tongue root advancement during stop closure does not always have a phonetic motivation to facilitate vocal fold vibration – it can be rather associated with phonological voicing, as shown in English /b, d, g/.

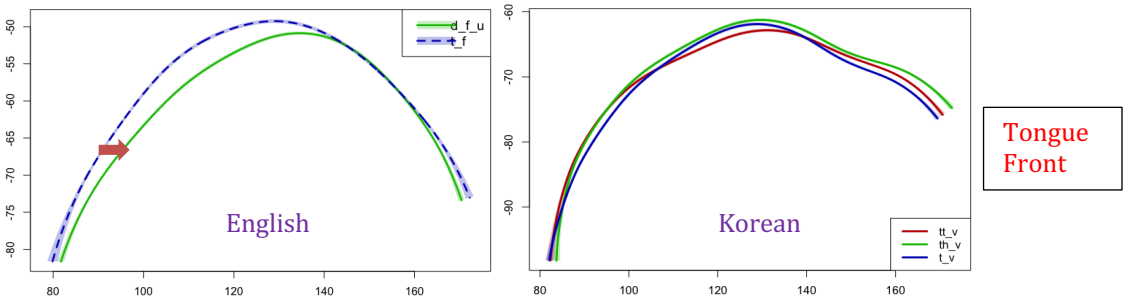

Figure 1. Sentence-medial post-vocalic position: One representative speaker of each language
English: /d/ (green) vs. /t/ (blue), Korean: /t/ (blue) vs. /t^h/ (green) vs. /t*/ (red)

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