The Production of English liquids by native Mandarin speakers

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English liquids /l/ and /r/ often present challenges to non-native speakers. In Hong Kong English, for example, the liquids are often deleted (e.g. pro[bə]m for 'problem'), replaced (e.g. [l]ide for 'ride'), or vocalized (e.g. wi[u] for 'will'). The difficulty arises partly because there is only one liquid /l/ in the inventory of Cantonese, while there are two liquids /l/ and /r/ in English. While English and Mandarin show a rough one-to-one correspondence in liquids, there are still large differences in the phonetic details of the attested liquids. For example, Mandarin speakers often vocalize the final liquid in English (Deterding, 2006) and their /l/ is notably lighter than that of American English (Smith, 2010). This indicates that the acquisition of non-native sounds is not only conditioned by the sound inventories of the first and second languages, but it is also influenced by specific distribution and phonetic details of the sounds.

Other than some descriptive studies based on subjective transcriptions, however, there is no extensive experimental data on the production of English liquids produced by Mandarin speakers. The current project aims to examine articulatory patterns in both native and non-native liquid production using ultrasound imaging. Specifically, the goals of the current study are to explore the effect of native phonological systems on production patterns and investigate detailed articulatory characteristics of foreign categories.

In the ultrasound imaging, three Mandarin speakers produced liquid sounds in Mandarin and English in three vowel contexts /ɑ i u/. For Mandarin, /ɹ/ appeared in both onset and final positions, while /l/ was limited only to initial position. The target words were embedded in short pseudo-address phrases consisting of a name of a city followed by a name of a street for Mandarin (e.g. *Menggu **L**uban Men* 'The Luban Gate in Menggu' for initial /l/ in the /u/ vowel context) and a two-digit number followed by a name of a street for English (e.g. 22 ***L**oop Peak*). The word lists were randomized within a language type and repeated 5 times. For comparison with native English liquids, one English speaker was recorded reading the English stimuli list.

To capture the most prototypical articulation of each liquid, the frame containing the most raised tongue front was chosen for the /ɹ/ sound and the frame containing the most retracted tongue back was chosen for the /l/ sound for both language types. The articulation of the liquids was compared using a smoothing spline ANOVA (SS ANOVA, Davidson, 2006; Wahba, 1990). Our preliminary results showed that Mandarin speakers implemented two distinct gestures for English /l/s depending on syllable position. As shown in Figure 1 (top), the initial /l/ (light grey) shows a significantly more fronted tongue dorsum than the final /l/ (dark grey). In addition, the initial /l/ appears to make alveolar contact as indicated by a significantly raised tongue blade, while such raising was not observed for the final /l/. This is suggestive of l-vocalization, but more data is needed to draw conclusions. Figure 1 (bottom) illustrates non-native /ɹ/s in initial (light grey) and final (dark grey) positions. In this particular case, a bunched /ɹ/ gesture was implemented in both positions. Full quantitative and qualitative analyses will be carried out and the results will be discussed with respect to various linguistics factors, i.e. native vs. non-native liquids, vowel effects, and positional effects.

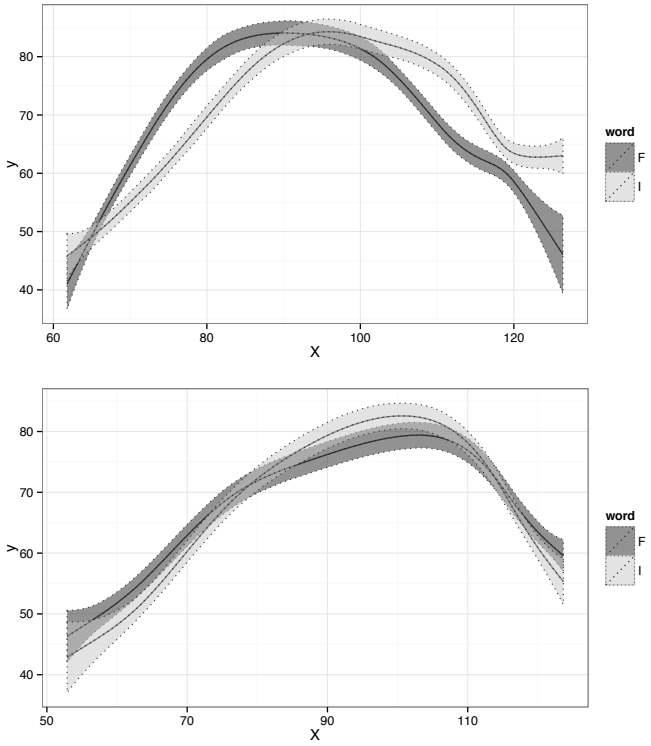

Figure 1. Smoothing spline estimate and 95% Bayesian confidence interval for comparison of the mean curves for one Mandarin speaker. **Top**. The tongue shape for the initial /l/ in *30 **L**ee Mount* (light grey) and final /l/ in *19 Pee**l** Peak* (dark grey) **Bottom**. The tongue shape for the initial /ɹ/ in *60 **R**eam Boulevard* (light grey) and final /l/ in *16 Bee**r** Peak* (dark grey). The tongue tip is on the right and the tongue dorsum is on the left.

References

Davidson, Lisa. 2006. Comparing tongue shapes from ultrasound imaging using smoothing spline analysis of variance. *Journal of the Acoustical Society of America* 120 (1): 407-415.

Deterding, D., Wong, J. & Kirkpatrick, A. 2008. The pronunciation of Hong Kong English. *English World-Wide* 29:148–175.

Smith, J. G. 2010. Acoustic Properties of English /l/ and /ɹ/ Produced by Mandarin Chinese Speakers, University of Toronto. MA thesis, University of Toronto.

Wahba, Grace. 1990. *Spline Models for Observational Data*. Philadephia: Society of Industrial and Applied Mathematics.