**Articulatory-based mappings for second language speech discrimination**

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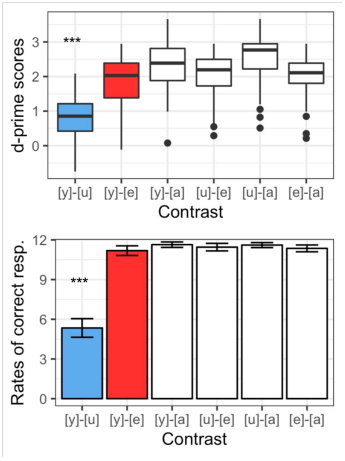
Second language (L2) speech perception is influenced by a variety of factors, both linguistic (e.g. structures of the interacting phonological systems within one speaker) and non-linguistic (e.g. age or manner of acquisition). One phenomenon that has been extensively documented is phonetic assimilation, in which L2 listeners perceive nonnative sounds according to their native categories. However, it is still not clear if (L2) speech perception abilities are based on articulatory or acoustic representations of sounds. Some frameworks (Best, 1995; Fowler, 1986) postulate that (L2) sound representations include articulatory mappings, and thus that L2 phonetic confusions are based on the articulatory properties of the L1 and the L2: if an L2 sound articulatorily resembles an L1 sound, it would be categorized as an instance of the L1 category (articulatory-mapping hypothesis). Some other frameworks argue that sound representations are acoustically-based (Flege, 1995; Ohala, 1996), thus suggesting that acoustic proximity is more predictive of phonetic assimilation patterns (acoustic-space hypothesis).

To address this we examined assimilation processes of a front-rounded French vowel in English listeners. Front-rounded French [y], a vowel that is absent from the English inventory, resembles [u] given that both involve the *rounded* articulatory feature. However, [y] and English [e] are closer in first-formant by second-formant (F1/F2) acoustic space. The articulatory-mapping hypothesis predicts that L2 listeners of French will have difficulty discriminating [y] from [u], given the common *rounded* articulatory feature in both, versus its absence in [e]. In contrast, the acoustic-space hypothesis predicts that L2 listeners will have difficulties discriminating [y] from [e], given their proximity in acoustic space, but not from [u].

Speech discrimination data from 64 L2 listeners of Canadian French (English L1) with little-to-no knowledge of French was collected. All listeners completed an AX task, in which they discriminated pairs of syllables containing [y], [u], [e] and filler [ɑ] vowels, (inter-stimulus interval = 500 ms). We included 72 *different* trials (12 for each [y]-[u] and [y]-[e] target pairs, and [u]-[e], [y]-[ɑ], [u]-[ɑ], [e]-[ɑ] fillers) and 72 *same* trials, in random order. We measured *d'* scores, an indication of sensitivity to contrast, and compiled rates of correct responses. Results show that both *d'* scores and rates of correct responses (out of 12 for *different* pairs) were significantly lower for [y]-[u] pairs (in blue) than for all the other (different) pairs, including [y]-[e] pairs (in red), as supported by linear mixed-effects models (*est. range* = 1.02 to 1.7, $p < 0.001$ for *d'* scores; *est. range* = 5.8 to 6.3, $p < 0.001$ for correct-response rates).




The results cannot be attributed to acoustic proximity in F1/F2 space and instead suggest that articulatory mappings participate in L2 phonetic discrimination. However, other acoustic correlates to roundedness such as the third formant have been shown to impact perception of this articulatory property, but its interaction with other acoustic characteristics (e.g. F2) makes it difficult to formally predict discrimination patterns based on it. Investigating front-rounded [y] vs. front-unrounded [i] would also inform us on the question of acoustic vs. articulatory mapping for nonnative sound discrimination. Further research will thus be necessary to formally investigate these possibilities and shed some light on the fundamental questions of the nature of phonetic information specification in L1 and L2 representations.

**References**

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