Bunched-retroflex variation in acquisition and sound change

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Covert articulatory variation provides opportunities to investigate how children deal with many-to-one articulatory-acoustic mappings, and to explore the role of phonetics in language change at the level of the individual speaker. We report a series of acoustic and articulatory studies of children and adults exhibiting inter- and intra-speaker variation in the tongue postures used to articulate postalveolar approximants. English /ɹ/ is of special interest for the study of articulatory variation, because it exhibits acoustic stability (e.g. low F3, Delattre and Freeman 1968) despite considerable articulatory variability, both within and between speakers (Delattre and Freeman, 1968; Mielke et al., 2010). We show how this variability relates to children's exploratory behavior, and how the same type of articulatory variation manifests itself in a sound change in progress in Canadian French.

In English-speaking children, /ɹ/ is often one of the last sounds to be acquired, especially in prevocalic contexts (e.g., McGowan et al. 2004), and Tiede et al. (2011) have argued that children might attempt different vocal tract configurations during acquisition. We report longitudinal articulatory data on /ɹ/ production data by four typically developing English-speaking children, aged between 3 and 6 years, which shows that the four children exhibit distinct patterns of /ɹ/ articulation and development, much like adults in previous studies (e.g., Mielke et al. 2010). The results show that exploratory behavior mirrors adult allophony patterns, and that the development of /ɹ/ production strategies are non-deterministic. This is based on two twins who produce /ɹ/ with completely different tongue shapes. Further, delayed /ɹ/ production was observed in contexts that conflict with an individual's dominant tongue posture: one child produced exclusively bunched /ɹ/ and was delayed in prevocalic contexts where retroflex /ɹ/ is more common among adults (Figure 1), with the exception of post-coronal prevocalic contexts, which stands out as a context where adults often bunch, even if they retroflex in other prevocalic contexts (Mielke et al., 2010).

A related phenomenon is the development of rhotic vowels in Canadian French (i.e., mid front rounded vowels /ø/, /œ/, and /œ̃/ produced with a rhotic perceptual quality, much like English [ɹ], leading the words *heureux*, *docteur*, and *commun* to sound like [ɹʁɹ], [dɔktʌɹʁ], and [kɔmɹ̃]). When asked, native speakers typically are completely unaware of the difference between rhotic and non-rhotic pronunciations, suggesting that rhoticity is a change from below. Empirical data on changes from below is sparse in the first place (Labov, 1994), and this phenomenon also involves the emergence of a new allophone that can be produced with categorically different (bunched and retroflex) tongue shapes, something which has previously only been investigated as a case of stable individual variation in English.

Articulatory imaging reveals that bunched tongue shapes are used to produce all moderately rhotic vowels and most extremely rhotic vowels. Figure 2 shows examples of tongue shapes for two extremely rhotic speakers. One young speaker who produced extremely rhotic vowels produced them with retroflex tongue shapes, suggesting that the use of retroflexion emerged only after the change progressed to the point where the perceptual target was extreme enough to motivate a learner to use a non-vowel-like tongue posture. Therefore, retroflexion may be diagnostic for the change moving beyond its initial phonetic motivation. A prediction of this is that there should be no retroflexion among older speakers.
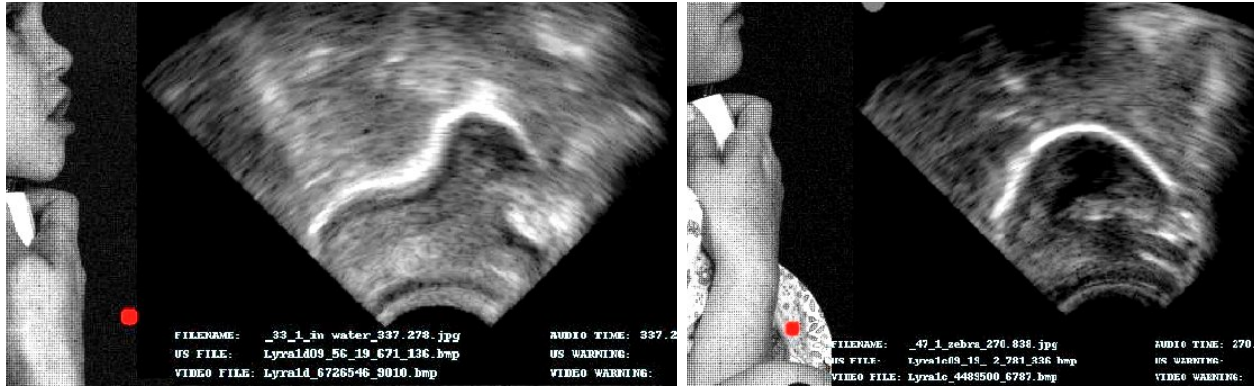
Figure 1: Left: adult-like bunched /ɹ/ in 'water' (in a context where bunching is common in adults); right: non-adult-like /ɹ/ in 'zebra' (in a context where retroflexion is more common).
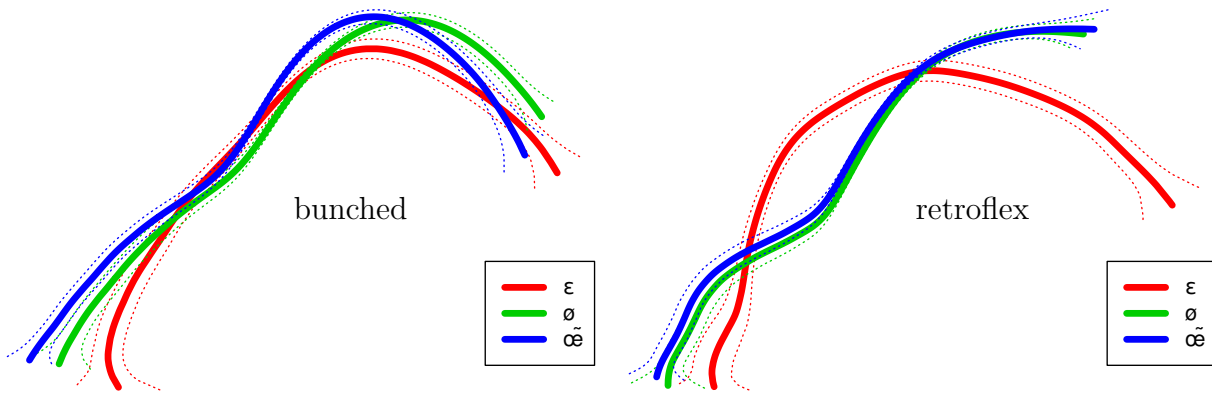

Figure 2: Tongue contours for two speakers' rhotic vowels, with non-rhotic vowel [ɛ] for reference.

References

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