

Understanding qualitative change in prerhotic vowels through the use of Ultrasound Tongue Imaging.

Postvocalic /r/ has had a significant and varied historical impact on the development of vowels in Germanic languages, causing contradictory vowel modifications such as lowering, retraction, centralization, raising, fronting and rounding of vowels, see Campbell (1959:§139), Dobson (1957:§198-218), Marshall Denton (2001), Hiller (2012). Prerhotic vowel changes are often used as the basis for reconstruction of historical forms of /r/, e.g. Lass and Anderson (1975), Lass (1983), Marshall Denton (2001); however, researchers typically do not support their assumptions about the coarticulatory influence of /r/ with empirical articulatory evidence. We will provide evidence of the very different coarticulatory effects of covert articulatory variants of postvocalic /r/ on prerhotic vowels in a rhotic variety of contemporary English (Scottish English).

Our study focusses on the prerhotic unrounded mid vowels /ɪ/, /ɛ/, /ʌ/ in Scottish English, as postvocalic /r/ has a strong effect on the quality these vowels. We carried out an acoustic and articulatory analysis of vowel tokens in word-list speech style, taken from a socially-stratified audio-ultrasound tongue imaging corpus (15 speakers, 8 working-class speakers and 7 middle-class speakers).

In an earlier analysis of this data, middle-class speakers were found to use bunched variants (see Delattre and Freeman 1968) of postvocalic /r/ almost without exception, while working-class speakers had a preference for /r/ variants where the tongue front or tip was raised to the (post)alveolar region (anonymous 2011). We will show how the presence of these different configurational /r/ variants can explain a longstanding divergence between prerhotic /ɪ/, /ɛ/, /ʌ/ vowels in working-class and middle-class Scottish speech.

Our acoustic analysis of the data confirmed that middle-class speakers in the corpus centralize and neutralize /ɪ/, /ɛ/ and /ʌ/ before /r/, while the working-class speakers retract /ɛ/ to [ɛ̠] and neutralise /ɪ/ and /ʌ/ to [ʌ]. In order to identify the coarticulatory effect of /r/ on /ɪ/, /ɛ/ and /ʌ/, we compared the average midsagittal tongue configuration from the onset of prerhotic /ɪ/, /ɛ/ and /ʌ/ with the average midsagittal tongue configuration for postvocalic /r/ at its point of maximum constriction. Our results show that for each middle-class speaker in the study, the average tongue configurations at the onset of prerhotic /ɪ/, /ɛ/ and /ʌ/ closely match the location and shape of the average tongue configurations for their bunched /r/. For the working-class speakers in the study, only the location of the tongue root of /ɪ/, /ɛ/ and /ʌ/ is similar to that of the speakers' /r/s; although for some speakers the tongue root is more retracted during the vowel onset than at the point of maximum constriction for /r/. Our results suggest that bunched /r/ exerts a centralizing influence over preceding /ɪ/, /ɛ/, /ʌ/, resulting in vowel merger [ə/ɘ], while the secondary root-retraction articulation of tongue-tip/front raised /r/ results in retraction and lowering of the /ɪ/, /ɛ/, /ʌ/ vowels in working-class speech. Moreover, the stronger coarticulatory influence of middle-class bunched /r/, which has a dorso-palatal constriction, compared with that of working-class tip/front-raised /r/s is supported by the *degree of articulatory constraint* model of coarticulation, e.g. (see Recasens et al 1997, Recasens and Espinosa 2009) where consonants produced at the alveolopalatal or palatal zone exert a stronger coarticulatory influence over adjacent vowels than alveolars do.

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