

Top-down and bottom-up influences in English s-retraction

Some speakers of English exhibit a retracted production of /s/ in stɹ clusters, e.g. /st.ɪŋ/ → [st.ɪŋ] ‘string’ (Shapiro 1995, Lawrence 2000, Armstrong 2003, Durian 2004). /ɹ/ is a crucial element of the conditioning environment for the retraction of /s/ (‘sting’ is [stɪŋ], not [stɪŋ]). Since /ɹ/ involves a constriction in the palato-alveolar region, we hypothesized that the retracted /s/ production is a conventionalization of the coarticulation of /s/ with /ɹ/ (Janda and Joseph 2001, Durian 2004). It is known that there are multiple speaker-specific and context-specific articulatory postures associated with /ɹ/ (Delattre and Freeman 1968, Tiede *et al.* 2004; Mielke *et al.* 2006). We expect the extent of /ɹ/-/s/ coarticulation to be different for different /ɹ/ postures. Specifically, we hypothesized speakers with a greater distance between the /ɹ/ and /s/ postures to have a greater coarticulatory effect in the production of /s/. We present acoustic and articulatory evidence from 26 speakers that support these hypotheses. The dependence of the phonetic motivation for s-retraction on speaker-specific phonetic factors suggests that the sound change was initiated by a subset of speakers, for phonetic reasons, but that others adopted the change for social reasons (Janda 1999, Janda and Joseph 2001).

Impressionistically, retracted /s/ is more ʃ-like than non-retracted /s/. This difference in quality can be quantified by calculating the centroid frequency of the fricative. The centroid is the weighted average (or center of gravity) of the power spectrum above 1 kHz. Higher centroid frequencies represent a more s-like sound, and lower centroid frequencies more ʃ-like sounds. Figure 1 shows the distribution of sibilants for a speaker who retracts /s/ in the str context. As expected, [s] and [ʃ] have distinct distributions. Productions from the /str/ cluster, shown in gray, form a distribution distinct from both /s/ and /ʃ/ (respectively, $F(1,57) = 696.42$, $p < .0001$, and $F(1,24) = 209.71$, $p < .0001$).

Non-retractors’ production of /ɹ/ in an str cluster were compared to the /s/ from an /st/ cluster; each speaker was judged to have /ɹ/ and /s/ productions that were either similar or dissimilar. Representative shapes are given in Figure 2 to illustrate these judgments. Statistical tests revealed that speakers with more dissimilar /ɹ/-/s/ shapes had centroid frequencies 256 Hz lower (i.e., more coarticulation) than those with more similar /ɹ/-/s/ shapes (within-subjects ANOVA, $F(1,78) = 10.036$, $p < 0.0021$). This confirms that different /ɹ/ postures produce different coarticulatory effects.

Present-day retractors include speakers both with and without the phonetic motivation for retraction. Moreover, in present-day retractors with the phonetic motivation for retraction, the difference of the centroid frequency of /s/ and retracted /s/ is greater than can be attributed to the effect of coarticulation alone. This indicates that modern-day retractors retract /s/ for both social and phonetic reasons.

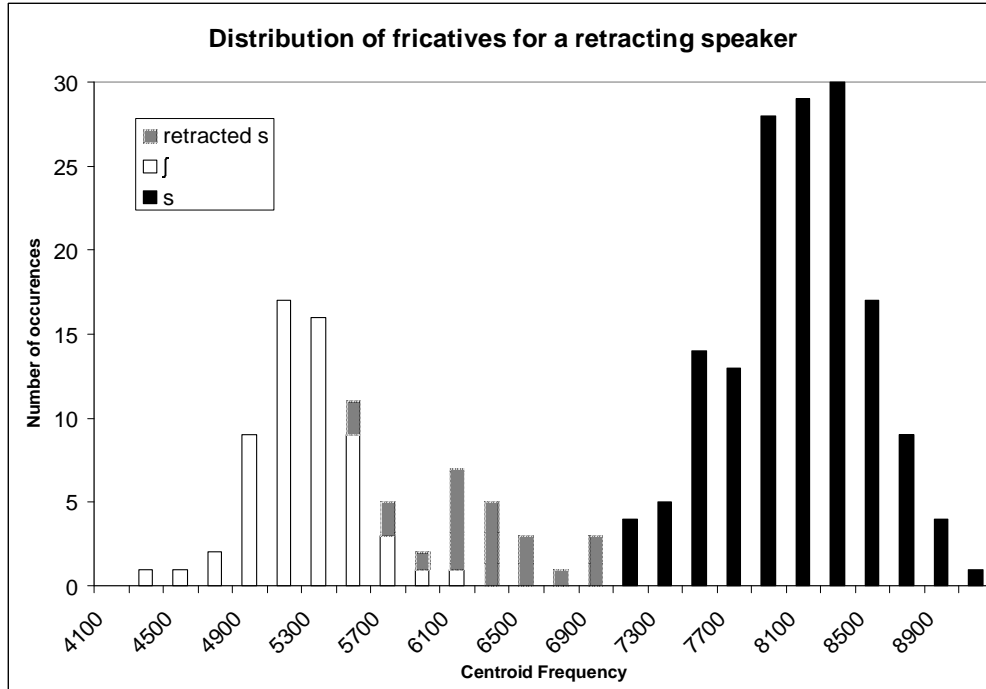


Figure 1

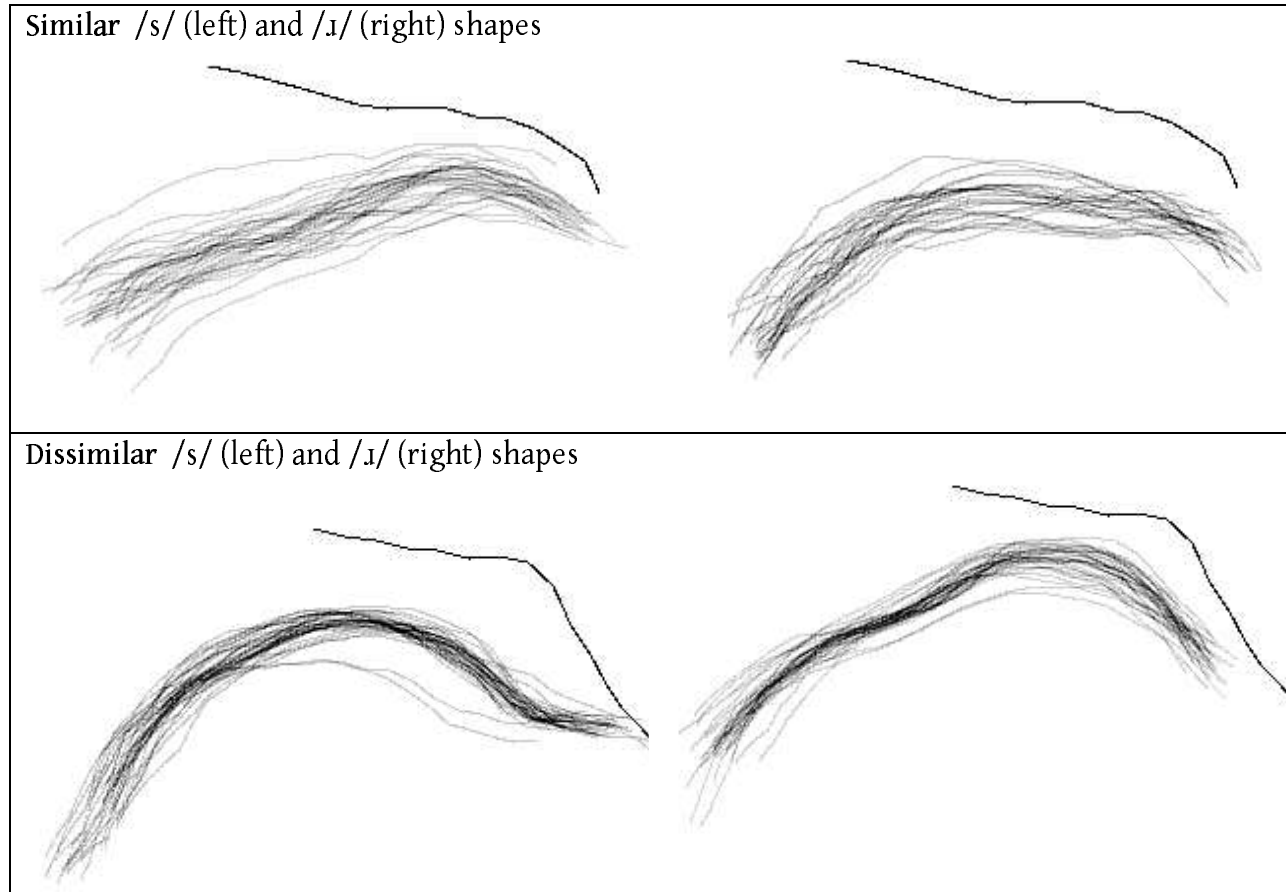


Figure 2