/s/-retraction, /t/-deletion and regional variation in New Zealand English /str/ and /stj/ clusters

Paul Warren

School of Linguistics and Applied Language Studies
Victoria University of Wellington, NZ
paul.warren@vuw.ac.nz

Abstract

A survey of /s/-retraction phenomena in recordings from the New Zealand Spoken English Database shows that retraction of /s/ to an /ʃ/-like articulation is frequently accompanied by incomplete closure of the /t/. This /t/-deletion is more frequent in /stj/ sequences, while /s/-retraction is more frequent in /str/ sequences. This pattern is interpreted in terms of the relative sequencing of assimilation and deletion processes in the two cases. In addition, age-grading in the distribution of both of these phenomena is significant in the Hamilton section of the NZSED materials, but not in the Wellington recordings. This pattern appears to support a diffusion account of the retraction phenomena from larger to smaller communities.

1. Introduction

/s/-retraction, i.e. the realisation of /s/ as an /ʃ/-like post-alveolar or palato-alveolar consonant (often with either a retroflex or a cupped/grooved tongue configuration) has been widely observed in a number of English varieties (Janda & Joseph, 2003; Labov, 1984; Shapiro, 1995), including New Zealand English (Bauer & Warren, 2004; Lawrence, 2000; Maclagan, 2000). Although there are suggestions that the phenomenon has long standing (Lawrence, 2000: 85), it is generally argued to be a recent and spreading innovation, which is, in American English at least, "getting to be strikingly rampant" (Janda & Joseph, 2003: 215). Bauer and Warren (2004: 594) comment on its frequency in New Zealand English (NZE), and personal observation is that it is more widespread amongst younger speakers, suggesting that in NZE too /s/-retraction is spreading. Indeed, in her review of NZE pronunciation features, Maclagan (2000) lists it amongst the "more recent changes."

Most commentators on /s/-retraction focus on its incidence in /str/ and secondarily in /stj/ clusters. However, Janda and Joseph (2003) report observing retraction in a range of other contexts, most (but not all) of which involve a neighbouring /r/ (e.g. *understand* [from rhotic speakers], *disrespect*) or an /r/ with an intervening voiceless stop (usually but not always /t/ - cf. *screen*, *sprinkler*). Cases across word boundaries are also attested (Lawrence 2000: 82 cites *last race*). However, Janda and Joseph (2003) maintain on the basis of the relative frequency and earlier attestation of retraction in /str/ contexts that the latter probably provided the point of origin of the innovation.

The nature of /s/-retraction is the subject of some debate. In the /str/ context, for instance, it has been claimed to result from a distant assimilation – i.e. across the intervening /t/ – of /s/ to /r/ (Baker, Mielke, & Archangeli, 2006a, 2006b; Shapiro, 1995), but also from a local assimilation of /s/ to an affricated realisation of /tr/ (Lawrence, 2000), and from an assimilation of the whole cluster (including /t/) to a retroflexed /r/, followed by a reinterpretation of the retroflexion in the cluster by younger speakers as [ʃtɹ] (Bauer & Warren, 2004). It is, of course, quite possible that the same or similar effect may result from different causes for different speakers or different speech varieties, and that – as Bauer and Warren suggest – an articulatory configuration used by one group of speakers is reinterpreted as a different configuration by other speakers. As an example of the range of different articulations found in one community, consider the ultrasound study of /str/ articulations carried out by Baker et al. (2006a), who identify three sub-types of retraction, which they term 'canonical retraction', 'palatalization' and 'retroflexion'. We will return to discussion of the processes of retraction in the Discussion section.

As an investigation of the nature and spread of /s/-retraction in NZE, I present in this paper analyses of recordings collected as part of the New Zealand Spoken English Database (NZSED) project (Warren, 2002).

Proceedings of the 11th Australian International Conference on Speech Science & Technology, ed. Paul Warren & Catherine I. Watson. ISBN 0 9581946 2 9
University of Auckland, New Zealand. December 6-8, 2006.

Accepted after abstract only review

2. Method

2.1. Materials

As one component of the NZSED project, participants read aloud 200 phonetically-diverse sentences, based on the materials used in the ANDOSL project (Vonwiller, Rogers, Cleirigh, & Lewis, 1996). These sentences include six instances of /str/ in the onset of stressed syllables (in the words (*strange*, *strawberries*, *street*, *strength*, *stroke*, *strong*), and one at the onset of an unstressed syllable (*pedestrian*). In addition, the sentence materials contain two instances of /stj/ (*student* and the proper name *Stewart*), which are also analysed below because of the light they shed on the progress of /s/-retraction.

The NZSED project is based on two North Island centres – Wellington and Hamilton. Wellington, the capital city of New Zealand has an urban area population of some 370,000, while Hamilton is a provincial centre with a population of around 185,000 (Statistics New Zealand, 2006). A previous comparison of fronting of the FOOT vowel in speakers from these two centres, using NZSED data, has suggested that the provincial centre is lagging behind Wellington in the spread of sound change (Kennedy, 2004).

While both Pākehā (European New Zealanders) and Māori speakers of English have been recorded in both centres for NZSED, the data-sets for the latter group of speakers are incomplete. Therefore the analysis reported here concentrates on the recordings from the Pākehā speakers. In each centre, the project team has recorded at least six females and six males in each of three age groups (18-30, 31-45 and 46+). A total of 37 female and 36 male Pakeha speakers have been analysed, giving a total of 511 /str/ and 146 /stj/ tokens.

2.2. Analysis procedure

Detailed auditory and acoustic phonetic analyses of the /str/ and /stj/ sequences have considered the nature both of the fricative and of the following /t/. Amongst other measures, /s/ was categorised as unretracted [s], as retracted (i.e. producing an [ʃ]-like fricative), or as a partially retracted form, typically starting with [s]-like energy, with a drop in the frequency distribution of the fricative noise towards an [ʃ]-like pattern (as illustrated in Figure 1). As this analysis proceeded, it was noticed that many speakers failed to complete a closure for the /t/ in these strings. The absence of a clear /t/ closure in /str/ has also been remarked on by Janda and Joseph (2003: 214), who noted that some speakers realise this as [ʃr]. In the NZSED data the lack of closure generally coincided with a partial reduction in friction energy, as in Figure 2, though there could be a complete absence of closure gesture, as in Figure 1.

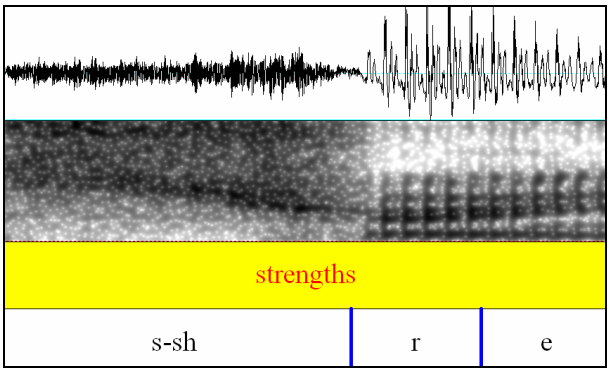

Figure 1: Example of a partially retracted form in a /str/ sequence. Note also the absence of a /t/ closure. The frequency display in the spectrogram is to 8 kHz.

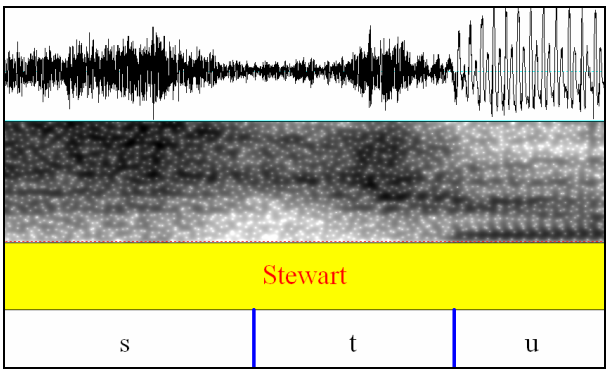

Figure 2: Example of a /stj/ sequence with a partial closure for /t/. Frequency display is as in Figure 1.

Shapiro (1995: 102) has similarly noted that an amplitude change in the frication noise is often sufficient to cue a stop in /str/ sequences. The NZSED data also revealed cases where the reduction of the articulation of the /t/ was so extreme that there was not even a noticeable reduction in friction energy. For the purposes of this paper, a simple distinction is made between cases where there is or is not a clear acoustic closure for /t/ in the /str/ and /stj/ sequences.

For both the /s/-retraction data and the /t/-deletion data, and for /str/ and /stj/ strings separately, logistic regression models were fit, taking into consideration the factors Speaker Sex (male, female), Region (Wellington, Hamilton), and Age (18-30, 31-45, 46+). Given the claims that /s/-retraction is a recent phenomenon, it is relevant to examine whether the incidence of retraction forms is dependent on the speakers' age, and also on whether it varies according to sex and/or region, which might reflect how the phenomenon might be spreading in NZE. A comparison of onset types is also of interest in the context of suggestions that /s/-retraction probably originated in the /str/ context (Janda & Joseph, 2003), and so an additional analysis compared retraction rates in /str/ and /stj/ sequences. All analyses involving /stj/ must

Proceedings of the 11th Australian International Conference on Speech Science & Technology, ed. Paul Warren & Catherine I. Watson. ISBN 0 9581946 2 9
University of Auckland, New Zealand. December 6-8, 2006.

Accepted after abstract only review

however be treated with a certain amount of caution, since there were only two tokens that included that sequence.

3. Results

3.1. /s/-retraction

3.1.1. /str/ tokens

The distribution of retracted forms for each /str/ token is shown in Figure 3. This figure shows clearly that the unstressed token in *pedestrian* is far less likely to result in retraction. This is most likely because the /str/ sequence crosses a phonological syllable boundary (/pə.ˈdɛs.tɹi.ən/), with the /s/ closing the stressed syllable and not forming part of an onset cluster.

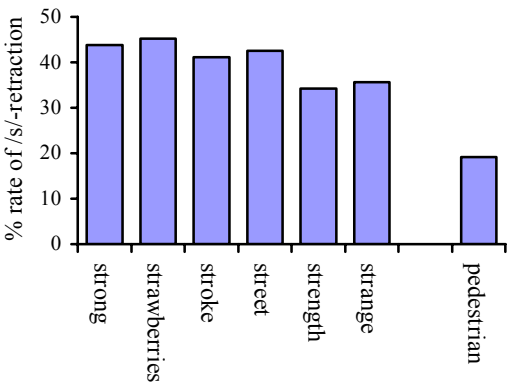

Figure 3: /s/-retraction in /str/, by token.

When *pedestrian* is excluded, the overall rate of retraction is 40%, more or less equally distributed between retracted and partially retracted forms, defined as above. For the logistic regression analysis, these fully and partially-retracted forms were grouped together as forms that showed evidence of retraction.

The best-fit model for the six remaining tokens (providing 438 data points across the 73 participants) showed a significant main effect of Speaker Sex ($p<0.001$), with males showing more evidence of retraction (48%) than females (33%). Neither of the other main effects was significant, but there was a significant interaction of Age and Region ($p<0.001$). As can be seen from Figure 4, the samples from Wellington speakers show a drop-off in the incidence of retraction as we move from older to younger speakers, while the Hamilton samples show a marked effect in the opposite direction. The oldest Hamilton speakers have the lowest rates overall, while the younger two groups of Hamilton speakers have comparable rates to the oldest Wellington speakers. Separate analyses of Age within each Region show that the pattern for the Wellington speakers did not achieve conventional levels of significance ($p<0.09$), while that for Hamilton speakers was highly significant ($p<0.002$). This result will be considered in more detail below.

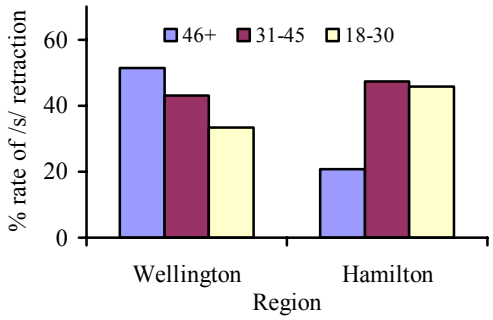

Figure 4: /s/-retraction in /str/, by age and region.

3.1.2. /stj/ tokens

The best fit model for the two /stj/ tokens, testing for the same factors as above, revealed a significant main effect for Speaker Sex ($p<0.01$) and no other significant effects. As with the /str/ sequences, males were more likely to retract (42% in this case) than females (14%).

3.1.3. Comparison of /str/ and /stj/ tokens

In line with Janda and Joseph's (2003) observation, /s/-retraction is more likely in /str/ strings (40%) than in /stj/ strings (23%). A simple χ^2 analysis of counts of retracted and non-retracted instances showed that this difference was significant ($\chi^2 = 11.03$, df: 1, $p<0.001$).

3.2. /t/-deletion

3.2.1. /str/ tokens

The analysis in this section continues to exclude *pedestrian*, to allow greater comparability with the retraction data, even though this word did not produce a noticeably different rate of /s/-retraction from the other tokens. The overall rate of /t/-deletion for the remaining six /str/ tokens was 26%. The logistic regression analysis indicated significant effects for Speaker Sex ($p<0.01$), Age ($p<0.001$), and for the interaction of Age and Region ($p<0.001$). The Speaker Sex effect was for a greater incidence of /t/-deletion amongst females (32%) than males (20%). The Age effect was for increasing deletion rates for younger speakers. The Age/Region interaction, displayed in Figure 5, shows no Age effect for Wellington speakers, but a marked increase in /t/-deletion for the youngest group of Hamilton speakers, when compared with all other speaker groups.

Proceedings of the 11th Australian International Conference on Speech Science & Technology, ed. Paul Warren & Catherine I. Watson. ISBN 0 9581946 2 9
University of Auckland, New Zealand. December 6-8, 2006.

Accepted after abstract only review

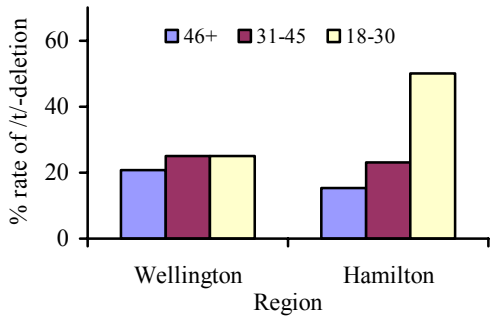

Figure 5: /t/-deletion in /str/, by age and region.

3.2.2. /stj/ tokens

The only significant effect revealed in the analysis of data for the two /stj/ tokens was for Region ($p<0.01$), with Wellington speakers (52%) more likely to have an incomplete closure than Hamilton speakers (30%).

3.2.3. Comparison of /str/ and /stj/ tokens

/t/-deletion was more likely in the /stj/ sequence (41%) than in the /str/ sequence (26%). A simple χ^2 analysis of counts of instances with and without /t/-deletion showed that this difference was significant ($\chi^2 = 11.10$, df: 1, $p<0.001$).

4. Discussion

The analysis of sentence data above aimed to shed some light on the nature and progression of /s/-retraction in NZE. This discussion section will first focus on the pattern of incidence of /s/-retraction, before then considering the process of retraction and of its relationship with /t/-deletion.

4.1. The spread of /s/-retraction

The current analysis includes a number of results that are compatible with observations and comments in the literature concerning the distribution of retracted forms of /s/. First, /s/-retraction is more widespread in the /str/ context than in the /stj/ context. As noted above, Janda and Joseph (2003) suggested that /s/-retraction may have had /str/ as its point of origin, but that it has since spread beyond this context. Janda and Joseph discuss this in terms of their "Big Bang" model of the spread of sound change, by which a phonetically-motivated change becomes adopted in non-motivating contexts, and lexical and/or sociolinguistic conditioning may start to play a role. During this process, the original phonetic motivation may also become "forgotten" (Ohala, 1992), as a sound change becomes established. However, although the current data show more retraction in /str/ than in /stj/, it should be recalled that the /stj/ context also provides a phonetic motivation for retraction. As noted by Bauer and Warren (2004: 594), /stj/ sequences can result in "coalescent assimilation" of /tj/ to [tʃ], and this post-alveolar affricate triggers retraction of the /s/. As a result, and in the absence of further data, we are not well placed to evaluate the spread of /s/-retraction to phonetically unmotivated contexts in NZE.

Second, there is a greater incidence of /s/-retraction amongst men. Maclagan (2000) also noted that the young men in her Canterbury data seemed to be leading the way in /s/-retraction, although at much reduced levels compared with the data presented in the current paper. Durian (2004) also noted higher levels of retraction amongst male speakers, but only for his African American speakers – the Caucasians in his data-set were more likely to retract if they were female.

Third, the nature of the spread of /s/-retraction through the NZE population is revealed by the significant interaction of Age and Region in retraction rates. This interaction, and the subsequent discovery of a significant simple effect of Age in the Hamilton data but not in the Wellington data, suggests that there is a change in progress in Hamilton (though we must also remain open to the possibility that retraction is a youthful fad that older speakers have grown out of), but not in Wellington. In particular, as can be seen from Figure 4, there is in Hamilton a change in /s/-retraction incidence that distinguishes the older group of speakers (with low rates of retraction) from the other two groups. A similar age distribution of /s/-retraction was also reported by Durian (2004) for both African American and Caucasian speakers in the USA, for a much smaller corpus, and an age effect has previously been observed for the Canterbury Corpus of NZE by Maclagan (2000), for the one item *street*.

Note though that the two younger Hamilton groups show similar levels of retraction to the oldest and middle groups in Wellington. This suggests that the Hamilton speakers might be lagging behind the Wellington speakers in terms of an increased incidence of /s/-retraction. Kennedy (2004) noted a similar difference between these regions in her analysis of FOOT fronting. These two sets of data may indicate a diffusion pattern in the spread of sound changes from a major centre (Wellington) to a smaller provincial centre (Hamilton) – more data needs to be investigated. The non-significant drop off in retraction rates across the Wellington speakers needs some additional explanation – one possibility is that (some of) the younger speakers are exhibiting hyper-correction.

Turning now to the patterns of realisation of /t/ in the /str/ and /stj/ sequences, we notice some commonalities with the retraction data, but also some interesting differences. Given that the deletion of /t/ has been noted as a phenomenon that sometimes accompanies /s/-retraction (Janda & Joseph, 2003;

Proceedings of the 11th Australian International Conference on Speech Science & Technology, ed. Paul Warren & Catherine I. Watson. ISBN 0 9581946 2 9
University of Auckland, New Zealand. December 6-8, 2006.

Accepted after abstract only review

Shapiro, 1995), we might expect that as the incidence of retraction spreads then so too does the incidence of /t/-deletion, and so the two phenomena would show similar distributional patterns. The main effect of speaker Age and the interaction of this factor with Region in the larger /str/ data set do indeed reflect the effects observed for /s/-retraction. Younger speakers do it more, and this trend is most noticeable in Hamilton. In addition, the level of /s/-retraction for each speaker correlates postively and significantly with that of /t/-deletion (Pearson's R= 0.308, $p<0.01$), indicating that these two phenomena may be (directly or indirectly) related. In terms of the ordering of these processes of /s/-retraction and /t/-deletion, we can read into Janda and Joseph's (2003: 214) remark that "[f]or some speakers, this particular cluster [i.e. /str/] can now even be realised as [ʃr]" an implication that deletion is consequent upon retraction. This would imply that the incidence of /t/ deletion would be somewhat lower than that of /s/-retraction. However, although /t/-deletion is overall slightly less prevalent than /s/-retraction, this is not true for the younger Hamilton speakers. For this group, at least, it would appear that some other factor is influencing /t/-deletion over and above /s/-retraction.

4.2. Assimilation and cluster simplification in the process of /s/-retraction

There is one important respect in which the /t/-deletion results differ from the /s/-retraction results. Recall that /t/-deletion is more likely in /stj/ than in /str/, while /s/-retraction is more likely in /str/ than in /stj/. In addition, deletion in /stj/ was more frequent than retraction. This means that for the /stj/ sequences at least, it cannot simply be the case that /t/-deletion is a secondary process, following /s/-retraction, as suggested above.

It seems that there may be two differing patterns of behaviour in the examples of retraction considered for this paper, both of which however involve a process of assimilation and a process of cluster simplification. On the one hand, /str/ sequences show /s/-retraction, via one of the assimilatory processes outlined in the Introduction, which may then be followed by /t/-deletion. The precise nature of the assimilation process may depend on the individual speaker (see Baker et al., 2006a) or dialect. An illustration of one such process (local assimilation following affrication of /tr/) is given in (1) below, where the subsequent cluster simplification to /ʃr/ is also shown. Variant pronunciations of /str/ will arise, depending on how far along the string of changes the speaker has come (so [stʃɹ], [ʃtʃɹ], [ʃtɹ] or [ʃɹ] in the particular example shown in (1)), as well as on the type of assimilation involved. Closer inspection of the range of pronunciations found within a community of speakers may shed more light on the nature of the assimilatory process.

$$\text{str} \rightarrow \text{stʃr} \rightarrow \text{ʃtʃr} \rightarrow \text{ʃtr} \ / \ \text{ʃr} \qquad (1)$$

On the other hand, the data for /stj/ sequences seems to suggest that in some cases the cluster simplification might occur earlier in the piece. That is, while the scenario in (2) reflects a sequence of coalescence of /tj/ to /tʃ/, assimilation of /s/ to the following /tʃ/ and cluster simplification, an earlier application of cluster simplification, before /s/-retraction, might result in the pattern in (3).

$$\text{stj} \rightarrow \text{stʃ} \rightarrow \text{ʃtʃ} \rightarrow \text{ʃt} \qquad (2)$$

$$\text{stj} \rightarrow \text{stʃ} \rightarrow \text{sʃ} \qquad (3)$$

Thus, (2) shows /s/-retraction without /t/-deletion, since the cluster simplification results from stopping of the affricate that resulted from the coalescence of /tj/, while (3) shows /t/-deletion without /s/-retraction. Outcomes such as (3) are in fact attested in the NZSED data (see Figure 6. Note also that Figure 1 above showed this phenomenon for a /str/ sequence). The change in fricative energy distribution visible in the /sʃ/ sequence in Figure 6 is sufficient – together with top-down lexical information – to cue a /t/ in perception. The fact that the data for /stj/ show more /t/-deletion than /s/-retraction suggests that the pattern in (3) might be quite widespread.

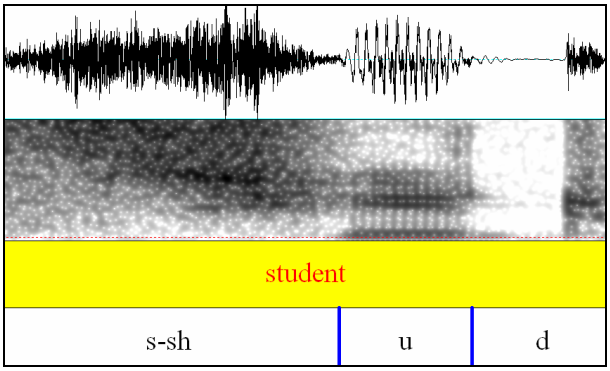

Figure 6: Example of a /stj/ sequence containing a /sʃ/ sequence for /stj/. Frequency display is as in Figure 1.

A final observation from the data analysed above is that women are more likely to show evidence of /t/-deletion while men are more likely to have /s/-retraction. In fact female retraction and deletion rates are about the same while males have twice as much retraction as deletion. In addition, the correlation reported above of /s/-retraction and /t/-deletion rates in the /str/ tokens is found in separate analysis of the female data (Pearson's R= 0.505, $p<0.01$), but not in the male data (Pearson's R= 0.145, ns). If /t/-deletion is consequent on /s/-retraction, as indicated above for these /str/ sequences, then this would suggest that

Proceedings of the 11th Australian International Conference on Speech Science & Technology, ed. Paul Warren & Catherine I. Watson. ISBN 0 9581946 2 9
University of Auckland, New Zealand. December 6-8, 2006.

Accepted after abstract only review

women are leading the way in this set of changes, were it not for the fact that the men have a higher overall rate of /s/-retraction.

5. Conclusion

The NZSED sentence data analysed in this paper have shown clear evidence of /s/-retraction in both Wellington and Hamilton, and evidence also that this is a change-in-progress that would seem to be further advanced in Wellington. This finding fits a diffusion model whereby a change percolates out from larger centres of population to smaller centres. Further study of other centres would be needed to confirm this speculative interpretation.

The data have also shown that the study of /s/-retraction phenomena also needs to take into account the deletion of /t/ in /str/ and /stj/ sequences such as those considered here. Closer inspection of these effects suggests that the processes of assimilation and cluster simplification that are involved might have different ordering possibilities for the two strings, resulting in the different relative frequencies of /s/-retraction and /t/-deletion observed in /str/ and /stj/.

6. References

Baker, A., Mielke, J., & Archangeli, D. (2006a). *Probing the Big Bang with ultrasound: retraction of /s/ in English.* Paper presented at the Linguistic Society of America, Albuquerque, NM.

Baker, A., Mielke, J., & Archangeli, D. (2006b). *Top-down and bottom-up influences in English s-retraction* Paper presented at NWAV 35, Columbus, OH, 9-12 November.

Bauer, L., & Warren, P. (2004). New Zealand English: phonology. In B. Kortmann, E. W. Schneider, K. Burridge, R. Mesthrie & C. Upton (Eds.), *A Handbook of Varieties of English: A Multimedia Reference Tool* (Vol. 1, pp. 580-602). Berlin: Mouton de Gruyter.

Durian, D. (2004). */s/-retraction and /l/- vocalization realization in Columbus AAVE speech: An impressionistic sociolinguistic analysis*. Unpublished manuscript, Columbus, Ohio: The Ohio State University.

Janda, R. D., & Joseph, B. D. (2003). Reconsidering the canons of sound-change: towards a "big bang" theory. In B. Blake & K. Burridge (Eds.), *Historical linguistics 2001: Selected papers from the 15th international conference on historical linguistics, Melbourne, 13-17 August 2001* (pp. 205-219). Amsterdam: John Benjamins.

Kennedy, M. (2004). *Vowel movement, vowel duration and regional variation: another adventure in the vowel system of New Zealand English* (Unpublished Honours Paper): Victoria University of Wellington.

Labov, W. (1984). Field methods of the project on linguistic change and variation. In J. Baugh & J. Sherzer (Eds.), *Language in use: readings in sociolinguistics* (pp. 28-53). Englewood Cliffs, NJ: Prentice-Hall.

Lawrence, W. (2000). /str/->/shtr/: assimilation at a distance? *American Speech, 75*, 82-87.

Maclagan, M. (2000). Where are we going in our language? New Zealand English today. *NZ Journal of Speech-Language Therapy, 53-54*, 14-20.

Ohala, J. J. (1992). What's cognitive, what's not, in sound change. In G. Kellermann & M. D. Morrissey (Eds.), *Diachrony within synchrony: Language history and cognition* (pp. 309-355). Frankfurt am Main: Peter Lang Verlag.

Shapiro, M. (1995). A case of distant assimilation: /str/->/shtr/. *American Speech, 70*, 101-107.

Statistics New Zealand. (2006). New Zealand in Profile 2006. Retrieved 10th November 2006, from http://www.stats.govt.nz/products-and-services/new-zealand-in-profile-2006/Population.htm

Vonwiller, J., Rogers, I., Cleirigh, C., & Lewis, W. (1996). Speaker and Material Selection for the Australian National Database of Spoken Language. *Journal of Quantitative Linguistics, 2*(3), 177-211.

Warren, P. (2002). NZSED: building and using a speech database for New Zealand English. *New Zealand English Journal, 16*, 53-58.

Proceedings of the 11th Australian International Conference on Speech Science & Technology, ed. Paul Warren & Catherine I. Watson. ISBN 0 9581946 2 9
University of Auckland, New Zealand. December 6-8, 2006.

Accepted after abstract only review