Sociophonetic patterning of phrase-final /t/ in New Zealand English

Gerry Docherty, Jen Hay and Abby Walker

School of Education Communication & Language Sciences
Newcastle University
g.j.docherty@ncl.ac.uk

Department of Linguistics
University of Canterbury
jen.hay@canterbury.ac.nz / ajw129@student.canterbury.ac.nz

Abstract

This paper analyses the realization of phrase-final /t/ in a corpus of young New Zealand English speakers. The results are discussed in the context of exemplar models of representation.

1. Background

Previous work on the realization of word-final /t/ in New Zealand English has reported glottal stop to be an incoming variant. The young speakers in Holmes' (1995) study produce between 21% (middle class male) and 44% (working class female) glottal stops. The 'leading edge' for this change, says Holmes, is "the conversational speech of young women". In this paper we examine phrase-final /t/ in the speech of young New Zealanders. We show that glottal variants are now much more prevalent than reported by Holmes. While women may indeed be implicated in this change, our data shows that at least in phrase-final position, young female speakers produce significantly fewer unreleased tokens than their male counterparts.

2. Methodology

The speakers were drawn from the Canterbury Corpus, which forms part of the ONZE archive held by the linguistics department at the University of Canterbury. The Canterbury Corpus contains over 400 interviews, which have been conducted since 1994 by students enrolled in a 3rd year 'New Zealand English' course. These are relatively informal sociolinguistic interviews, which last for at least half an hour, and are followed by a standard New Zealand English word list. In most cases the interviewee is an acquaintance or friend to the interviewer. The corpus is broadly stratified by social class into 'Professional' and 'Non-professional' speakers – a classification that is based on both educational and occupational criteria (see Gordon, Maclagan and Hay forthcoming for details). The speakers in the Canterbury Corpus were born between 1926 and 1985. We have selected an 'older' group and a 'younger' group for analysis. Only the analysis of the younger group is presented here.

This analysis consists a total of 1057 tokens from 60 speakers – 15 young professional females (FP), 15 young non-professional females (FN), and 30 males, also evenly split between professional and non-professional groups (MP and MN, respectively).

We wanted to focus on phrase-final /t/ - defining phrase-finality to be the end of an intonation phrase. Phrase-final /t/ has proven to be particularly interesting in other varieties of English (e.g. Docherty, Foulkes, Milroy, Milroy, & Walshaw 1997), and our initial impressionistic judgement pointed to likely interesting variation in New Zealand English too. Tokens were extracted using the ONZEminer software (Fromont & Hay ms), searching for tokens which occurred at the end of a breakpoint. While transcribers are not explicitly trained to begin each breakpoint at the beginning of an intonation phrase, in the vast majority of cases they do. This search strategy will therefore have missed some phrase-final tokens, but was a relatively efficient way of automatically identifying a large number of relevant tokens. The search strategy also returned some cases which were not, in fact, phrase final and these were not analysed. Final /t/s which formed part of a final consonant cluster were also not analysed.

3. Analysis

3.1. Overall results

Using a combination of auditory and acoustic methods, our analysis tracked the following 4 primary variants of /t/ encountered in the recordings :

- A canonical /t/ - a sustained voiceless closure followed by a clear release without sustained homorganic frication
- A spirantised /t/ - with no closure gap, and frication during the "stop" interval
- An affricated /t/ - with a closure gap, and a heavily fricated release.
- An unreleased stop almost always realised with accompanying glottalisation and often as a glottal stop

Our analysis also tracked the extent to which vowels preceding the released variants were produced with a degree of laryngealisation. All of the released variants were attested in both laryngealised and non-laryngealised form.

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

Table 1 shows the distribution of these forms over the four speaker groups. The vast majority of tokens were not released. Females used more released forms than males, and professional speakers used more released form than non-professional speakers.

Table 1: Distribution of categories of /t/ across four speaker groups. F=female, M=male, P=professional, N=non-professional.

	non-released	canonic-al	spirantized	affricated
FP	70.8% (153)	9.3% (20)	13.9% (30)	6% (13)
FN	78.1% (285)	12.3% (45)	6.3% (23)	3.3% (12)
MP	76.2% (138)	10.5% (19)	9.9% (18)	3.3% (6)
MN	89.8% (265)	8.8% (26)	1% (3)	.3% (1)

In order to determine possible social and linguistic conditioning on these variants, all tokens were coded for the following independent variables:

- **gender**: speaker gender
- **class**: speaker class
- **speaker:** position in speaker's turn (prepausal, prehesitation, turn-final)
- **listener:** listener reaction (say nothing, overlap, take the floor)
- **celex freq**: the log wordform frequency from the CELEX lexical database (Baayen, Piepenbrock and Gulikers 1995)
- **local freq**: the word frequency as it occurs in this specific database of phrase final /t/s – normalised to span the same frequency range as the CELEX frequency.
- **freq diff**: The difference between the above two log frequency counts (**local freq** minus **celex freq**).
- **open close**: Whether the word is open or closed class.
- **word group**: Whether the word is 'but', 'that', 'it' or something else.

When variables that have more than two codes were initially retained in our models, the significance of the co-efficients was examined in order to determine whether the variable should be further collapsed. This practice led to the use of the following additional variables in some of our models:

- **hesitation:** is the /t/ pre-hesitation or not.
- **but**: is the /t/ in the lexical item '*but*'.

In all cases where these two variables are reported as significant, the larger variable was first tested, and then collapsed down to these binary variables based on lack of significant difference between the other categories.

3.2. Probability of release

First, we fit a logistic regression model, investigating the probability of the /t/ being released. Canonical, spirantised, and affricated /t/ were all collapsed together as 'released' variants. The anova for the resulting model is shown in table 2. In order to make the directions of the effects clear, figures 1 and 2 plot the log odds for the various effects from the model, while holding all other variables constant. First, as shown in the left panel of figure 1, both gender and social class have a significant effect, as would be expected based on the trends observed in table 1. These effects interact. Females produce more released forms than males. And while there is a small social class effect for females, social class plays a large role for males, with professional males producing more released forms than non-professional males.

Table 2: Anova table for model of probability of release.

Factor	Chi-Square	d.f.	P
gender	15.11	2	0.0005
class	15.41	2	0.0005
hesitation	16.6	2	0.0002
open close	10.37	2	0.0056
Freq diff	6	1	0.0143
But	9.31	1	0.0023
celex freq	8.86	1	0.0029
gender x class	5.46	1	0.0195
hesitation x openclose	10.12	1	0.0015
TOTAL INTERACTION	15.36	2	0.0005
TOTAL	108.33	9	<.0001

The right panel of figure 1 shows the effect of the word being pre-hesitation. For open class words, a pre-hesitation word is much less likely to result in release than a word which is not pre-hesitation. For closed class words, however, there is no effect of hesitation.

We should note that, despite the use of line graphs, the independent variables plotted in figure 1 are all discrete. When plotting interactions between discrete variables, we use a line to connect corresponding points, and make clearly visible the nature of the interaction. This makes the direction and the nature of the interaction very easy to see, but the line is not intended to suggest any continuity.

Figure 2 plots the remaining effects from the model. There is an effect of the frequency of the word. The log CELEX frequency and the log local frequency are highly correlated (spearman's=.87, p<.00001), and they both perform equally well in the model. We therefore include the CELEX counts in the model as they are based on a much bigger corpus, and so likely to be more robust. As shown in the left panel of figure 2, more frequent words are less likely to be released.

Interestingly, the difference between the frequency in our small corpus of phrase final /t/s and the CELEX frequency was also a significant predictor. For positive values of **freq diff**, the word was relatively more frequent in our corpus than in CELEX. For negative values, it was relatively more frequent in CELEX. **Freq diff** spans -3.59 (*let*) to 7.26 (the proper names *Kat* and *Bridget*), with a median of 0 (*it*). As shown in the middle panel of figure 2, the more frequent a

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

word is in phrase-final position relative to its frequency in CELEX, the less likely it is to be released. This seems to be capturing an effect of phrase-final frequency. Note that this is not simply acting as a corrective for our choice of the CELEX frequency – which one might be tempted to assume isn't a completely accurate representation of frequency of use in our New Zealand corpus. If we replace CELEX frequency with local frequency in the model, the effect of the frequency difference is still in the same direction and of the same magnitude. What we believe **freq diff** is capturing is the fact that words that tend to occur phrase-finally a high proportion of the time are even less likely to be released than words of equivalent frequency which are less likely to occur phrase-finally. *Let*, for example, is a frequent word, but it is not particularly frequent phrase finally. The more a word tends to occur phrase-finally rather than phrase medially, the less likely it is to be released in final position.

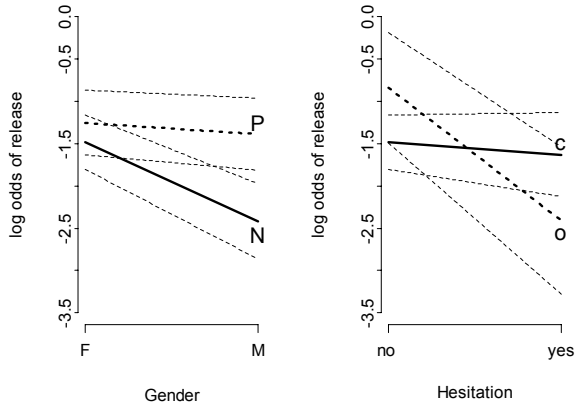

Figure 1: Model effects showing log odds of release. Left panel shows interaction between gender and social class. Right panel shows interaction between hesitation and open/closed class. Dashed lines show 95% CIs.

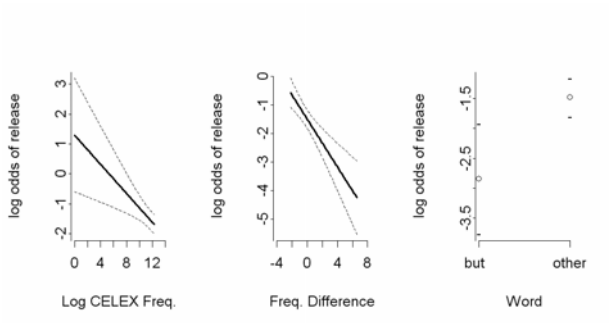

Figure 2: Model effects showing log odds of release. Left panel shows effect of lexical frequency. Middle panel shows the effect of phrase-finality – with words which are generally more likely to occur in phrase-final position showing decreased probability of release. Right panel shows effect of the lexical item '*but*'. Dashed lines show 95% CIs.

Finally, the rightmost panel of figure 2 shows a word-specific lexical effect. Our data-set contains 281 tokens of '*it'*, 213 tokens of '*that'* and 150 tokens of '*but'*. While *it* and *that* behave as one would expect for words of their frequency, *but* seems to display some word-specific behaviour. It is much less likely to be released than other words.

3.3. Probability of Fricated Release

Next, we set aside the non-released variants, in order to investigate the factors which were likely to govern the three different types of released variant which were identified in the data. Despite the fact that released tokens were in a clear minority, we were interested in whether there might be some interesting patterns with this small subset of our data-set. This seemed to be likely, given the relative perceptual prominence of the released tokens, which in many cases arose from the fact that they were produced with frication which was extended in time.

Of the 216 released tokens, 49% were released with a degree of frication in excess of that typically found for a canonical stop, as a result of either spirantisation (34%) or affrication (15%). We fit a logistic model over just the released tokens in order to determine whether there were any social or linguistic factors which could predict this pattern of increased frication.

Our initial attempt at fitting a model showed that the factors predicting the likelihood of a fricated release seemed to display a remarkable resemblance to those factors predicting the likelihood of release over the entire data-set. In order to examine this further, we separated out the speakers who produced at least one released token (46 speakers), and investigated the relationship between their rate of release, and their rate of frication when they did release. This relationship is shown in figure 3. The correlation is by no means perfect, however it is highly significant. The more likely a speaker is to produce a released token, the more likely they are to fricate that token when they do release it.

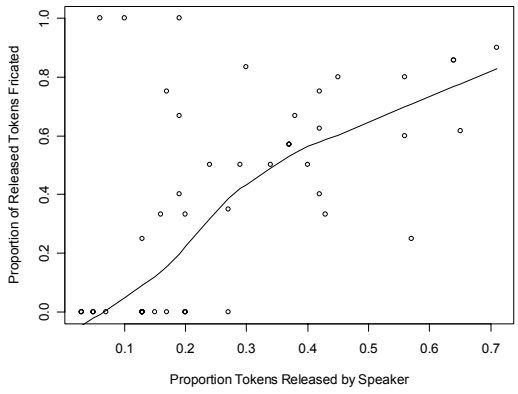

Figure 3: Correlation between the proportion of total tokens released by a speaker, and the proportion of those tokens which have a fricated release. Spearmans correlation coefficient = .54, p< .001). The line shows a non-parametric scatterplot smoother fit through the

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

points.

We therefore built this directly into our logistic regression model by including an independent variable **release rate**: which was the proportion of tokens which that speaker had actually released. This was highly significant, along with several other independent variables, as shown in table 3.

There are effects of gender and social class which echo the effects already reported for rate of release. Females are more likely to have releases which are fricated, and so are professional speakers. In this model, the two effects do not interact. Note that the effect of gender and social class is particularly strong, here, as these are still retained as separate significant predictors over and above the speaker's overall release rate.

Table 3: Anova table for model of frication probability.

Factor	Chi-Square	d.f.	P
Gender	12.33	1	0.0004
Class	4.31	1	0.0378
Open close	5.32	1	0.0211
release rate	22.12	1	<.0001
TOTAL	39.24	4	<.0001

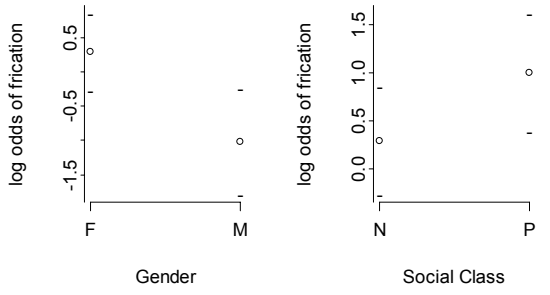

Figure 4: Model effects showing log odds of released token being fricated. Left panel shows effect of gender Right panel shows effect of social class. Dashed lines show 95% confidence intervals.

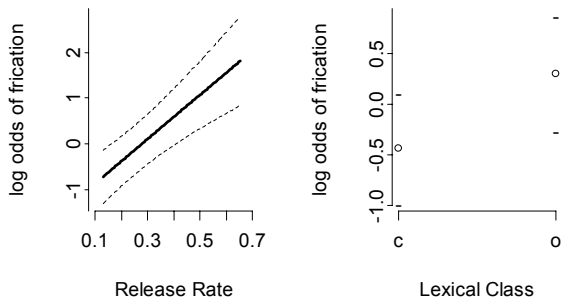

Figure 5: Model effects showing log odds of released token being fricated. Left panel shows effect of overall speaker release rate. Right panel shows effect of lexical class (o=open class, c=closed class). Dashed lines show 95% CIs.

The effect of the speaker's release rate is shown in the left panel of figure 5. Finally, as shown in the right panel of figure 5, there is an effect of open vs closed class lexical items, with open class items more likely to be fricated. Lexical class interacted with hesitation in our previous model, but there is not really enough data for a robust interaction to emerge here. Only 19% (42 tokens) of our released tokens occur in pre-hesitation position. That pre-hesitation tokens are in a minority here no doubt accounts for the fact that the directionality of this main effect echoes the non-pre-hesitation data from figure 2.

3.4. Laryngealization

As already noted, a surprising number of the released tokens also contained a degree of laryngealisation during the preceding vowel, mainly in the second half of the vowel. This is a pattern that has not been reported in other varieties in the absence of a glottal variant, and is somewhat counter-intuitive given the key role of vocal fold *ab*duction in the V-plosive transition in generating the aerodynamic conditions necessary for the production of the substantial frication associated with spirantisation or affrication (see Docherty forthcoming). We attempted to fit a logistic regression model over the released tokens to establish whether any of our independent factors could predict the occurence of laryngealisation. This revealed two significant factors. First, there was a significant effect of social class, with professional speakers producing more laryngealisation ($p<.01$). 76% of the released tokens produced by the professional speakers were also laryngealised, as compared to 55% for the non-professional speakers. There was also a signficant effect of local frequency – the word frequency in our database of phrase-final /t/. More frequent words are more likely to be laryngealised ($p<.02$). In this model of laryngealisation, the local frequency performs better than the CELEX frequency, which is only significant to $p<.06$. These results certainly suggest something interesting with respect to laryngealisation. Further investigation is required to determine whether this pattern is specific to the realization of /t/, or whether it reflects a more general phrase-final phenomenon in New Zealand English.

4. Discussion

In Bayard's (1990) analysis of wordlists and reading passages, young New Zealanders produced about 29% glottal stop forms. The rate of non-release was negatively correlated with social class. In 1995, Holmes found higher rates of glottal stops in her analysis of interview data. Working class young females produced the highest rates of non-release (44%), whereas the lowest rates were produced by middle class males (21%). We can't directly compare our own results to the figures, because our data is limited to phrase-final position, and these studies analysed final /t/ phrase medially as well. But our results do, nonetheless, provide a strong indication that unreleased glottal/ised variants are occurring at much higher rates than these studies of just 10 years ago. Over our entire data set, 80% of tokens were unreleased. Also, while our results support the findings of both Bayard and Holmes

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

that non-professional speakers produce more non-released forms than professional speakers, We have no evidence that females are leading the change – on the contrary – males in our study produce significantly more non-released forms than the females.

In terms of understanding the factors influencing the likelihood of release, we have been able to provide a more nuanced analysis than previous approaches. One way in which we did this was by incorporating a variety of frequency related measures in our model.

We found that frequent words are less likely to be released. This is consistent with two types of frequency effects which have been reported in the literature. First, frequent words have a tendency to lead sound change (see discussion in Labov 1994), and so this should predict that frequent words are more ahead in the shift towards unreleased forms. Second, frequent words tend to be produced with greater economy of effort (see, e.g. Wright 1997). Since it presumably takes more effort to release the /t/ than to not release it, the fact that frequent word are less likely to be released is consistent with the observed patterns.

Pierrehumbert (2002) has provided an account of how frequent words come to lead sound change, within the framework of exemplar-based theory of speech production and speech perception. Exemplar-based approaches assume that encountered words are stored complete with contextual and phonetic detail. Cognitive representations of words consist of distributions of remembered exemplars. Producing a word involves generalizing over a relevant subpart of the stored distribution. Because frequent words are encountered more often than infrequent ones, listeners are exposed to more variants of frequent words which contain the incoming variant. This shifts the distribution of frequent words more quickly in the direction of the ongoing change. An exemplar approach can therefore provide a compelling account of why frequent words should show highest rates of non-release.

Such an approach would also predict that the context that a word tends to occur in most often may also influence its production when it appears in other contexts. This is because the phonetic characteristics facilitated by the most frequent context will tend to dominate the distribution of the word as a whole. Indeed, this type of effect has been reported by Bybee (2002:274) who argues that "even holding frequency constant, a word that occurs more often in the right context for a change will undergo the change more rapidly than a word that occurs less often in the conditioning context." This is exactly the effect that we believe our **freqdiff** variable is capturing. Words that are more likely to occur in final position, are more likely to be unreleased when they do.

On the face of it, the interaction of **hesitation** and whether the word is open or closed class runs counter to our other finding that higher frequency tokens are more likely to be unreleased (in our corpus closed class words were much or likely to occur before a hesitation than open class words). However, previous work on the phonetic properties associated with hesitations and other dysfluencies in spontaneous speech suggest that a more refined analysis is called for in pursuing our analysis of these effects. For example, Shriberg (2001:162) points out that dysfluencies can result in speakers "cutting-off" the production of a word in mid-stream, often abruptly and often accompanied by laryngealisation. On the other hand, Bell, Jurafsky, Fosler-Lussier, Girand, Gregory, and Gildea (2003)'s study of English function words suggests that dysfluencies lead to longer and less phonetically reduced tokens. Thus it would seem likely that the explanation for our **hesitation** effect as well as for its interaction with **open/close** is closely tied up to the effects of dysfluencies of various sorts on the realisation of lexical items and whether different categories of lexical item are differentially affected in this respect. In sum, open class words lead to greater rates of release (and spirantisation), consistent with our observations about low-frequency words both lagging change and requiring more careful articulation. Pre-hesitation, however, closed class items tend to be longer and less phonetically reduced, an effect which seems to lead them to be more likely to be released in this context.

There is a **word group** effect relating to the patterns of realization encountered with the lexical item "but" While the existence of a lexical effect is consistent with an exemplar-based model of representation, more work is needed to investigate the different functions fulfilled by "but" in our corpus. As shown by Norrick (2001) , "but" is harnessed in spontaneous speech for a number of discourse roles. In light of what is known about the role of phonetic variation associated with discourse markers within speech (e.g Local 2003) further investigation should investigate the extent to which the patterns of realization observed for phrase-final "but" in the present data-set correlate with the particular discourse function(s) which it is fulfilling.

The overall rate of release was relatively low – only 20% of tokens were released. We were interested in whether there were any interesting patterns occurring within this small subset of the data. As should be clear from the discussion above, exemplar theory tends to focus on the privileged status of high frequency words, and high frequency variants. However as Pierrehumbert (fc) has pointed out, "attention is not a simple function of frequency". She suggests that attention is grabbed by stimuli which are "most informative". The potential special status of low frequency items has not been discussed much in the exemplar theory literature, but there is ample evidence from psychology of the existence of a frequency paradox: where high frequency items are more easily recalled, low frequency items are more easily recognized (Karlsen & Snodgrass 2003). Relatively infrequent stimuli could be quite informative by virtue of their relative infrequency and so more likely to be remembered.

It seemed to us that the released variants of /t/ in our data-set were reasonably salient, particularly because many of them seemed to be released with an unusual degree of frication. As described above, we found that there was significant linguistic and social conditioning occurring within this subset of our data. One interpretation of the intricate patterning of our released variants could be that these low frequency items stand out from the background pattern, and so provide a prime site for the layering of socio-indexical meaning.

Strikingly, we found that the factors which conditioned the likelihood of a fricated release were very similar to those that governed the probability of release. In fact, the probability that a speaker will produce a released /t/ is a very good predictor of the probability that when they do produce a released /t/ it will contain frication.

We might expect to observe such a relationship if what was happening was a change in progress away from a fricated release, toward a canonical release, and then final to a non-

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

released form. With such a trajectory of change, we could straightforwardly argue that women were lagging in the change, and so produced the most fricated tokens, and the least non-released tokens. However there is no evidence that this is the explanation. In fact, in a sample of 20 older speakers (born between 1932 and 1940), we find that only 28% of the released /t/s were produced fell into the spirantised or affricated categories. The rate of fricated tokens has increased to 49% for the younger speakers.

Thus, there seems to have been change in two directions – towards a lack of release, and also towards a highly salient, fricated release. That there is a correlation between the rate of release, and the proportion of fricated releases, may simply indicate that the more speakers adopt one of these changes, the less likely they are to also adopt the other. But because a fricated release is a relatively salient form of /t/, this is also reminiscent of a finding by Hay & Maclagan (forthcoming), who demonstrate that there is a relationship between the frequency of use of intrusive /r/ in NZE, and the degree of constriction of the /r/. They argue "if the production target constitutes an averaging over a subpart of the exemplar space, it follows that the production target could potentially gradiently vary depending on the nature of that exemplar space.", and speculate that there may well be other consonants where there is "a link between the frequency of occurrence of the variable and its phonetic quality". We may well have such a link here.

5. Conclusions

Many aspects of the results from this analysis provide evidence in support of an exemplar approach. These aspects include the apparent link between the frequency of occurrence of a variant and its phonetic realization, the presence of a word frequency effect, the fact that this frequency effect is context sensitive, and the presence of a lexical-specific effect. In further work we will turn our attention more closely to our older sample, in order to better understand the trajectory of change, and establish the degree to which the observed independent effects are stable over time.

6. Acknowledgements

The data analysed here was collected by members of NZE class of the Linguistics Department at the University of Canterbury. The work done by members of the ONZE team in preparing the data, making transcriptions and obtaining background information is also acknowledged. We are also grateful to Robert Fromont for his work developing ONZEminer, and to the University of Canterbury for the visiting Erskine fellowship which enabled our collaboration.

7. References

Baayen, R. H., Piepenbrock, R., and Gulikers, L. (1995) The CELEX lexical database (CD-ROM), Linguistic Data Consortium, University of Pennsylvania, Philadelphia, PA.

Bayard, D. (1990) Minder, Mork and Mindy? (-t) Glottalisation and Post-vocalic (-r) in Younger New Zealand English Speakers. In A. Bell & J. Holmes (Ed) *New Zealand Ways of Speaking English*, Victoria University Press, Wellington, 149-164.

Bell, A.,D. Jurafsky, E. Fosler-Lussier, C. Girand, M. Gregory, & D. Gildea (2003) Effects of disfluencies, predictability, and utterance position on word form variation in English conversation. *Journal of the Acoustical Society of America* 113 (2), 1001-1024.

Bybee, J. (2002) Word frequency and context of use in the lexical diffusion of phonetically conditioned sound change. *Language Variation and Change* 14. 261-290.

Docherty, G.J., Foulkes, P., Milroy, J., Milroy, L. & Walshaw, D. (1997) Descriptive adequacy in phonology: a variationist perspective. *Journal of Linguistics* 33, 275-310.

Docherty, G.J. (forthcoming). Speech in its natural environment: accounting for social factors in phonetic variability. In Cole, J., & Hualde, J-I, (Ed) *Papers in Laboratory Phonology, IX*. Berlin: Mouton.

Fromont, R. & J. Hay (ms). ONZE Miner: Development of a browser-based research tool. Ms under review.

Gordon, E., M. Maclagan and J. Hay (forthcoming) The ONZE Corpus. To appear in Beal, J.C.; Corrigan, K.P.; Moisl, H. (Eds) *Using Unconventional Digital Corpora*: Volume 2: Diachronic Corpora. Palgrave Macmillan.

Hay, J. and M. Maclagan (forthcoming) Social and phonetic conditioners on the frequency and degree of intrusive /r/ in New Zealand English. To appear in Dennis Preston and Nancy Niedzielski (eds) *Methods in Sociophonetics*.

Holmes, J. (1995) Glottal stops in New Zealand English: an analysis of variants of word-final /t/. *Linguistics* 33, 433-463.

Karlsen, P. & J. Snodgrass (2004) The word-frequency paradox for recall/recognition occurs for pictures. *Psychological Research* 68(4), 271-276.

Labov, W. (1994). *Principles of Linguistic Change: Internal Factors.* Blackwells Publishers, Mass.

Local, J. (2003) Variable domains and variable relevance: interpreting phonetic exponents. *Journal of Phonetics,* 31, 321-339.

Norrick, N. (2001) Discourse markers in oral narrative. *Journal of Pragmatics,* 33(6), 849-878.

Pierrehumbert, J. (2002) Word-specific phonetics. in C. Gussenhoven and N. Warner eds. *Laboratory Phonology VII,* Mouton de Gruyter, Berlin. 101-140.

Pierrehumbert, J. (in press) The next Toolkit. To appear in *Journal of Phonetics.*

Shriberg, E. (2001) To 'errr' is human ecology and acoustics of speech disfluencies. *Journal of the International Phonetic Association* 31(1), 153-169.

Wright, R. (1997) Lexical competition and reduction in speech: A preliminary report. *Research on Spoken Language Processing. Progress Report* #21, 47-483. Speech Research Laboratory, Indiana University, Bloomington, IN.

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