Changing Values: An analysis of the PRICE phoneme for eight speakers of NZE[1]

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Abstract

This paper investigates the differing effect of gender and social class on the production of the PRICE phoneme in New Zealand English. The results indicate that males on the whole are more innovative in both monophthongisation and backwards shift, and that female professionals are the most conservative group. Interestingly, male professionals appear to be leading the monophthongisation trend.

1. Introduction

Work in sociolinguistics has a well-established focus on the influence of social factors on phonetic articulation, and increasingly there has been an emphasis on analytical technique to provide in-depth examinations of the variation that underpins language at every level. This study, although preliminary, seeks to investigate the variation in the PRICE or /ai/ phoneme in younger speakers of New Zealand English (NZE) from the point of view of gender and social class (either professional or non-professional). The focus on younger speakers is an attempt to follow trends identified in previous studies on the phoneme (mentioned below). This analysis shows that articulation of PRICE, with respect to the diphthong shift of the first element and also to the monophthongisation resulting from glide weakening, results from an interaction between these two social factors. Female professionals express a conservative pronunciation of the diphthong in relation to the non-professionals, but this distinction is not as evident for the male speakers, particularly in regard to monophthongisation, suggesting that the pronunciation difference and any attached stigma is losing salience for younger New Zealand males.

[1] I would like to express my thanks to my course convenor Margaret Maclagan for her help in this paper, completed as part of the LING303 undergraduate course at University of Canterbury. I would also like to thank Katie Drager and Jen Hay for their help with statistical analysis, and Jen Hay's assistance with scripts.

2. Background

Across what Peter Trudgill refers to as "colonial Englishes," (2004: 1) the PRICE phoneme is notable for its variation in pronunciation. NZE proves to be no exception to this rule, demonstrating a history of diphthong shift traceable to the nineteenth century (see Gordon et al 2004: 154-5). The first element of the PRICE diphthong has shifted increasingly back, as represented in Gordon et al (2004: 149), where [A] stands for a fully open central vowel:

[A > ɑ > ɒ > ɔ]

This is considered part of the greater diphthong shift affecting the group of closing diphthongs in general in NZE (that is, PRICE, MOUTH, FACE and GOAT). In addition, these sounds demonstrate what has been termed "glide weakening" where the second element compensates for shift by moving towards the first element (Gordon et al 2004: 149). For PRICE this translates:

[ɑi > ɑɛ] (Gordon et al 2004: 28)

The combined effect of the two processes has resulted in increased monophthongisation of PRICE in NZE; Gordon et al identify more innovative variants of PRICE as [ɔɜë] (2004: 28). Moreover, the changes in PRICE pronunciation have sociolinguistic links to professional status and gender. Non-professional speakers are known to be more innovative in PRICE shifting than professional speakers, and this has resulted in a social stigma accompanying the trait. Women have more conservative pronunciations of PRICE than men, a fact which has been linked to this stigma (see Labov 1990). Maclagan and Gordon found that for PRICE, professional women, especially older professional women, avoided the stigmatised variants, whereas the young non-professionals were the most innovative (1996: 7). The analysis by Maclagan et al (1999) supports these findings to an extent, but also notes that the stigma appeared to be losing ground amongst the younger professional females as their pronunciations were not as conservative as may have been expected.

3. Method

3.1 Data

The data analysed were taken from the recordings in the ONZE project, specifically from the Canterbury Corpus, which currently comprises over 400 speakers born between 1930 and 1984 (see Maclagan and Hay 2007). Eight young speakers born between 1975 and 1982 were selected, with two speakers representing each of the classes: male professional, male non-professional, female professional and female non-professional. The small number of speakers reflects that this is a preliminary study. The speakers were aged between nineteen and twenty-seven at the time of recording. Regrettably, the corpus does not record where speakers come from, and so effects of possible regional differences cannot be taken into consideration. Twenty-five to thirty tokens of stressed PRICE were extracted for each speaker from their transcripted interviews. The advantages and disadvantages of casual versus read materials have been variously discussed (e.g. in Milroy 1987) with word lists sometimes favoured for their precision in cross-speaker comparison. In the interests of this study, however, the available interview material was utilised through both a desire to examine the trends in unpremeditated speech and also an interest in comparison with previous PRICE analyses based on data from read material (for example Maclagan et al 1999).

3.2 Formant marking

The formant measurements were taken using the Praat acoustic software (Boersma and Weenink 2007), using textgrids to mark the target of the nucleus and offglide. These points were defined: the nucleus target was taken where F1 was at its highest, and the offglide target at the stable peak of F2. A Praat script was used to extract F1 and F2 values automatically. Any inconsistencies in Praat's formant tracker were later corrected by hand. Altogether, 222 tokens were collected and analysed across the eight speakers. Triphthongal tokens (such as "liar" and "firing") were avoided where possible, to limit any potential intruding effect of schwa. In places, however, the inclusion of such tokens was inevitable, for reasons of maintaining a comparable number of tokens per speaker. In such cases, care was taken to separate the schwa from the offglide of PRICE.

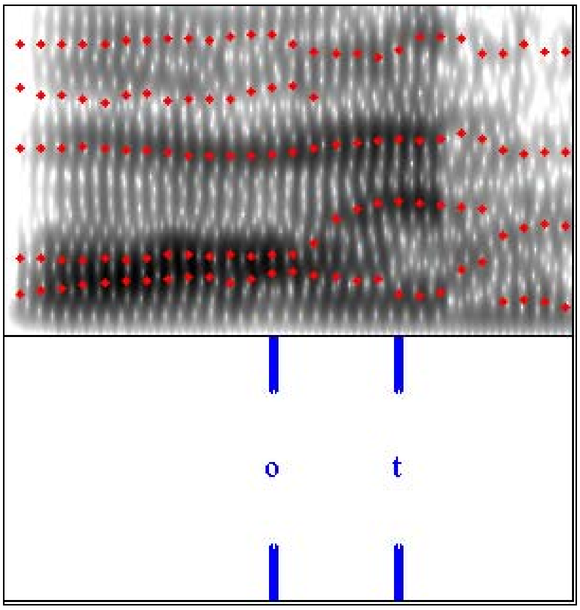


Figure 1: Example spectrogram of a marked token, showing the vowel in "find". o = nucleus target, t = offglide target.

4. Results

4.1 Euclidean Distance

To investigate the effects of social class and gender on the PRICE phoneme, a linear regression model was fitted to the data, modelling the Euclidean distance of a token. The Euclidean distance of the diphthong was calculated in the RGui statistical analysis program. This measurement examines the relative closeness of two vowels, and therefore can provide cross-speaker analysis without the need for normalisation (see Maclagan and Hay 2007: 13). In the context of this analysis, the Euclidean distance compares the relative closeness of the nucleus and the offglide of the diphthong, giving an indication of the monophthongisation of PRICE, and therefore the progress of both diphthong shift and glide weakening. Under the linear regression model, both gender ($p<0.001$) and class ($p<0.05$) have a significant effect on Euclidean distance. The coefficient and Anova tables (Tables 1 and 2 respectively; all tables are found in Appendix 1), demonstrate this.

Moreover, the model shows a significant interaction between gender and class ($p<0.001$). This demonstrates that not only are these social factors influential for PRICE, but their effect is in their combination. The relevant coefficient (Table 3) and Anova (Table 4) tables, along with the figures below, illustrate the correlation.

The line graph of Figure 2 shows the likelihood of tokens displaying a larger Euclidean distance (ie a more diphthongal vowel) plotted for non-professional (N) and professional (P) speakers. As can be seen, males and females display different trends. Professional females are more likely to have higher diphthongisation than their non-professional counterparts, whereas amongst males, professionals lead the trend towards monophthongisation. The realisation of PRICE is reliant not simply on gender or social class, but also on the combination of the two. The male results are uniformly lower than the female, which given that Euclidean distance is on the whole a relative measurement, indicates that male PRICE is overall more monophthongal.

Figure 2: Likelihood of a larger Euclidean Distance depending on gender and social class. M = male, F = female, N = non-professional, P = professional.

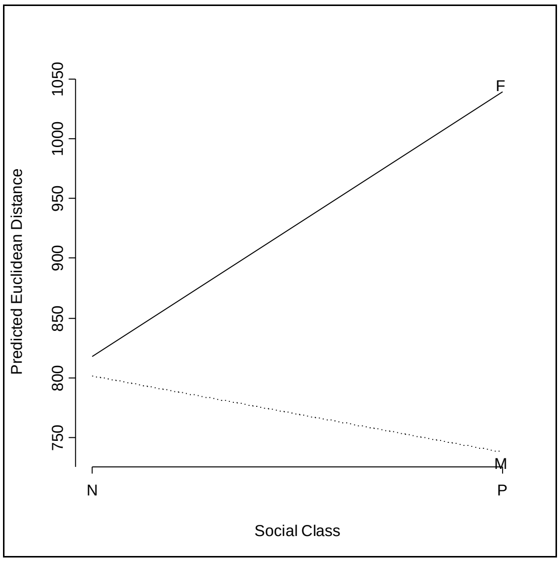
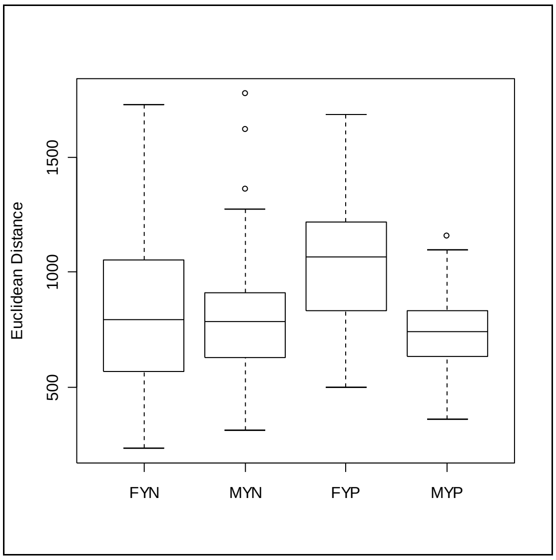


Figure 3: Boxplot of Euclidean Distance results for (left to right): female non-professionals (FYP), male non-professionals (MYP), female professionals (FYP), and male professionals (MYP).



The boxplot in Figure 3 indicates the distribution of tokens as per each social category for Euclidean distance. The boxes contain 50% of the data, with each bar containing a further 25%, and the line representing the median values. Female non-professionals have a far greater range of results than the other categories. In fact, some even produce tokens far more monophthongal and therefore more innovative than any token produced by a male. The higher median value for the FYP speakers and the lower value for the MYP show respectively the greater and lesser degree of diphthongisation for these two groups of speakers.

4.2 Formant analysis

In order to further investigate the dual processes of diphthong shifting and glide weakening, a linear regression model was also applied to the formants themselves. This allowed exploration of the acoustic position of the nucleus and offglide of PRICE, rather than simply their relative closeness as provided by the Euclidean distance results. The position of the nucleus is the more significant of the two, as it represents the well-documented diphthong shift of the first element. Moreover, since this movement is largely backwards moving, F2 is the more significant value. In order to analyse the formants, normalisation across the speakers was required. The method chosen for this was taken from *Instrumental Phonetics* (Thomas 2002). F0 values were automatically extracted from each token, and then the normalised formant values were calculated using the following formulae:

Normalised F1 = F1-F0
Normalised F2 = F2-F1

Although this method is not the most precise available, it offered the most concise process of formant normalisation whilst maintaining accuracy. The analysis of the normalised values again showed a significant combined effect of gender and class on the position of the nucleus, for both F2 ($p<0.05$) and F1 ($p<0.01$). The results for F2 are shown in Tables 5 and 6, and in Figures 4 and 5 below:

Figure 4: Likelihood of larger nucleus F2 depending on gender and social class of speaker

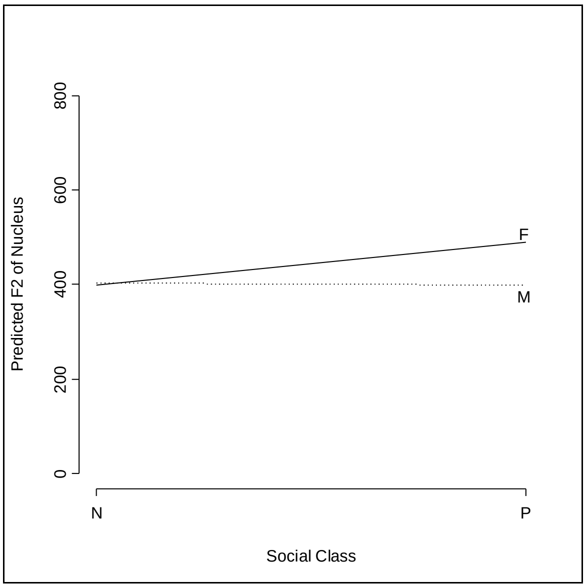
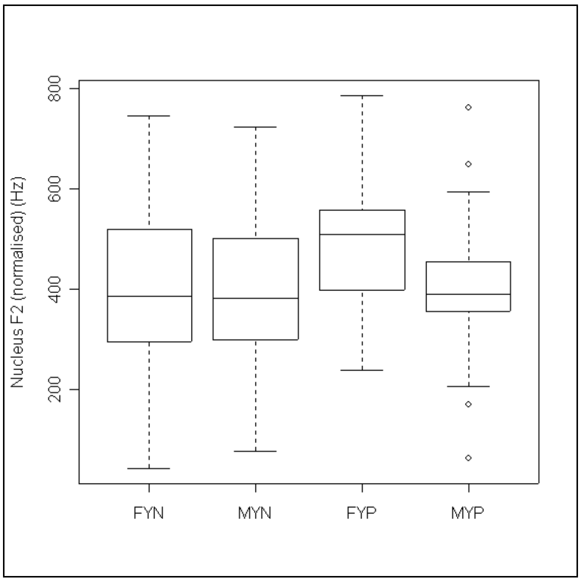


Figure 5: Boxplot of normalised nucleus F2 results for each speaker group



The direction of diphthong shift in the PRICE nucleus is towards both backness and closeness, with the F2 results indicating the former. Here again, the distinction is not made purely by gender or age, but by both together. Class is an important factor in the female results, with professionals more likely to have higher F2 values and thus more conservative pronunciations of PRICE. For the males, however, class barely exerts an influence on F2 value, with both professionals and non-professionals showing a low likelihood of high F2, and therefore more innovative pronunciations of PRICE. From this graph it can be interpreted that female professionals are maintaining a more conservative articulation of PRICE, with the change being led by the male professionals as well as non-professionals in general. This is clearly displayed in the boxplot in Figure 5, where the female professionals are set apart from the other classes.

With regard to F1, the results also reflect an influence of social factors consistent with the other findings. Again, the combined effect of class and gender is held to be significant ($p<0.01$). The male non-professionals are less likely than professionals to have a high F1 value (i.e. they display a more innovative, closer THOUGHT vowel), the reverse of the suggested trend seen in the females. The results for the F1 model are shown below, and in Tables 7 and 8:

Figure 6: Likelihood of larger nucleus F1 depending on gender and social class of speaker

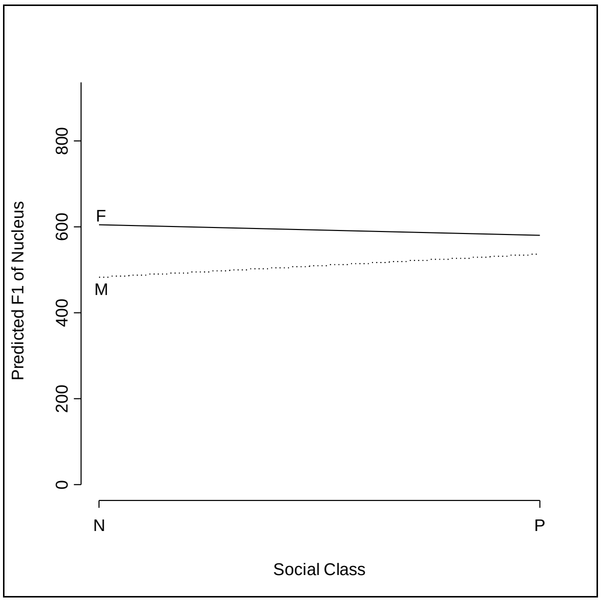


Figure 7: Boxplot of normalised nucleus F1 results for each speaker group

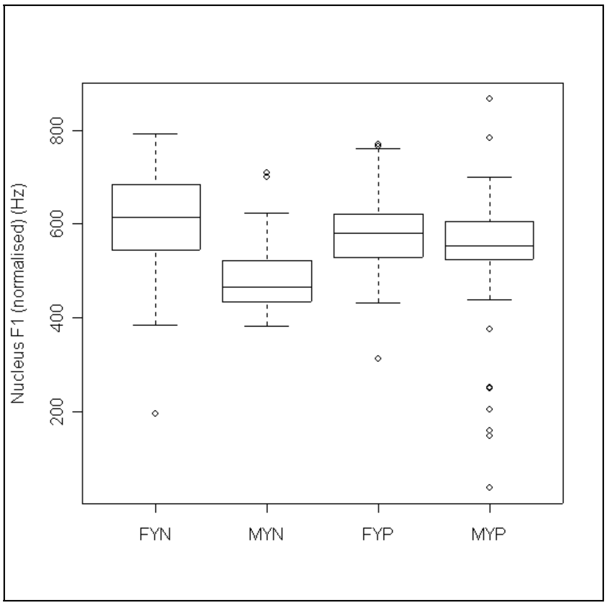
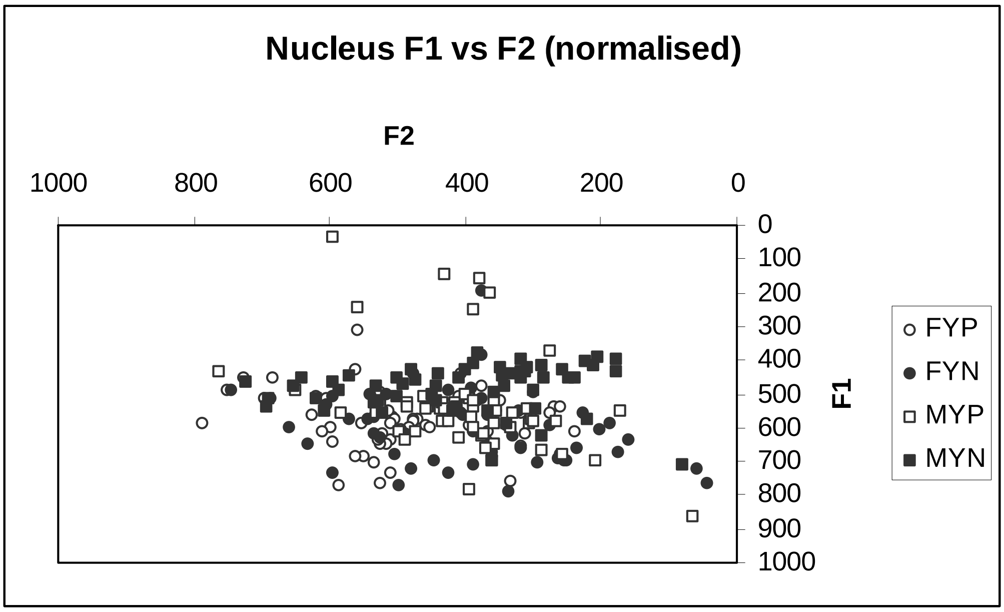


Figure 8: Scattergraph of normalised nucleus F1 against F2. Each point represents an individual token, coded for one of the four speaker groups: male professionals are represented by white squares, male non-professionals by black squares, female professionals by white circles, and female non-professionals by white squares.



This scattergraph of nucleus F1 and F2 (Figure 8) represents the framework of the vowel space, and concisely shows that the female professionals are more front and thus conservative in their pronunciation of PRICE than the other groups. In regard to F2, the male non-professionals are exhibiting the highest, most THOUGHT-like vowel. The direction of the innovative shift is therefore back and raising.

5. Discussion

Under this analysis, female professionals produce the most conservative forms of the PRICE diphthong, with non-professionals and male professionals continuing the trends in both the backward shifting of the nucleus and the monophthongisation of the vowel. This supports previous findings on larger sample groups that mark professional females as typically more conservative, particularly amongst the older speakers (Maclagan and Gordon 1996; Maclagan et al 1999). The results here suggest that young professional females follow a similar trend. The linear regression model showed that female non-professionals are far more likely than professionals to have shifted PRICE, whereas this distinction does not exist for the males. This suggests that the stigma attached to PRICE shift is not being observed amongst males but still has an effect amongst females. This goes against conclusions drawn in Maclagan et al (1999) that found female professionals to be more innovative than their male counterparts (1999: 32-33) in PRICE diphthong shift. As shown by the formant results, male professionals are roughly even with non-professionals in their backwards shifting of the nucleus, and show higher amounts of monophthongisation. In fact, the model shows that male professionals are more likely than any other group to have lower Euclidean distance values (i.e. more monophthongal PRICE). It is important to note, however, that for the nucleus formant values, male professionals displayed far greater variation than the other groups and included multiple outliers, as visible in the boxplots of Figures 5 and 7, as well as the scattergraph in Figure 8.

When the results presented here are considered in relation to previous work, the trend of monophthongisation presents the most interesting comparisons. Since only young speakers have been included in this study, Figure 9 shows the vowel space presented in Maclagan et al (1999), to which has been added the PRICE value as defined in Maclagan (1982). Although this framework is not normalised and based solely on male speakers, it provides a benchmark of sorts for comparison with the data in this study. In Figure 10, the median non-normalised formant results of each class in this study are presented on a vowel space of comparable scale. Median was selected to minimise the effect of the male professionals' outliers. Vocal tract differences account for much of the variation between the genders, but the trend towards more monophthongal PRICE is still clear. In relation to the formant values, the F2 of the nucleus is lower for the males than Maclagan's value, indicating that diphthong shift is still in effect for the younger speakers in this study.

Figure 9: The vowels of New Zealand English taken from Maclagan et al (1999) as per Maclagan (1982), with added PRICE as per Maclagan (1982)

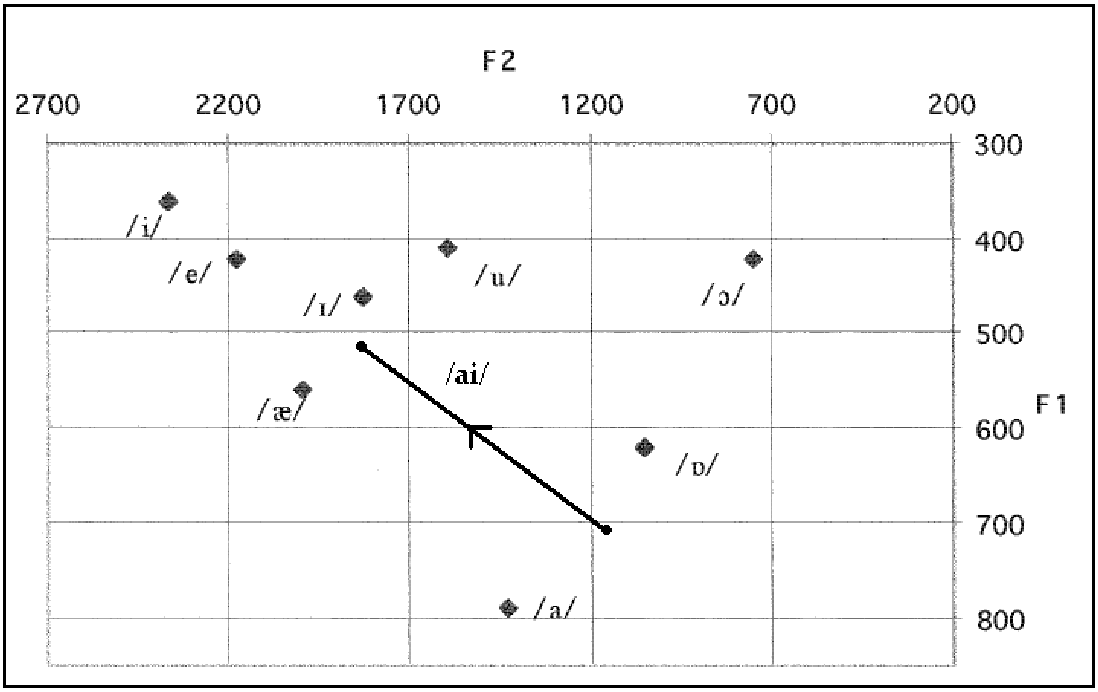
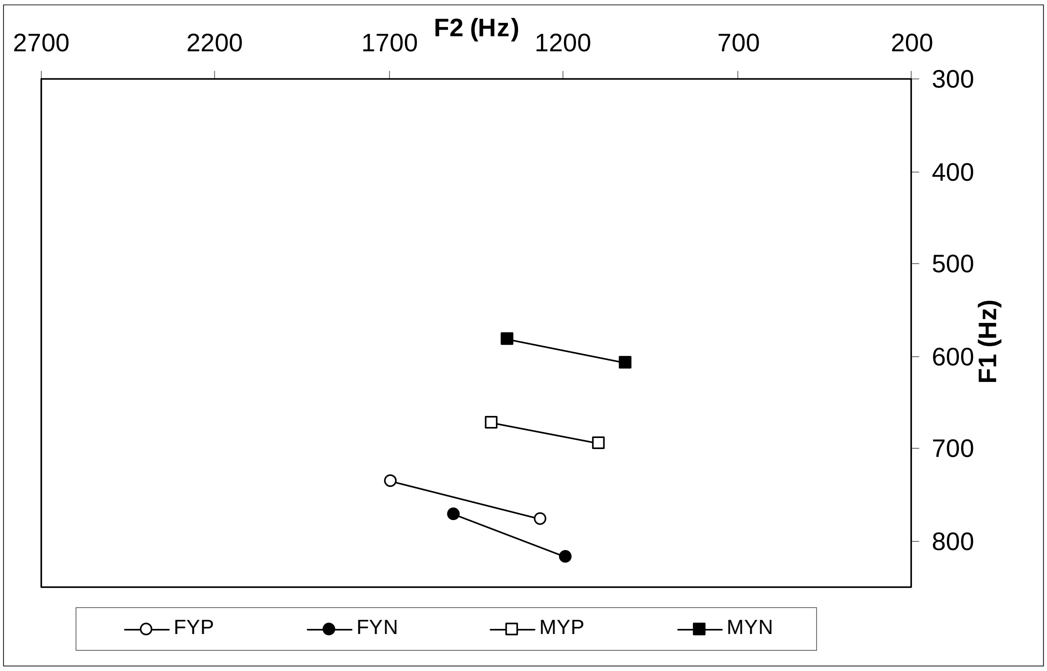


Figure 10: Median nucleus and offglide results (non-normalised) from this study for each speaker group, plotted in a F1/F2 space of PRICE. Right-hand points show the position of the nucleus, and the left-hand points show the position of the offglide. Again circles indicate the female groups, squares the males, with black representing non-professionals and white representing professionals.



6. Conclusions

The PRICE phoneme data presented here support Labov's claim that higher-class (in this study 'professional') women show a tendency to resist stigmatised variants. Interestingly, these data show that out of the four classes, male professionals exhibit the most innovation for the monophthongisation of the diphthong, in contrast to previous studies where innovative variants were predominant in non-professional speakers. The young female professionals in this analysis were markedly more conservative then their counterparts, displaying a lower amount of monophthongisation and maintaining the first element of the diphthong relatively forward of the other classes. The social motivation behind the variation is not, however, a clear gender split but the result of a significant interaction between gender and social class. Female professionals are more conservative, yet male professionals appear to be leading the trend in the monophthongisation of PRICE. Males overall are more innovative in the backwards shifting of the nucleus. It is notable that for this aspect of the variation, there is a strong social class distinction among the females, but not for the males. This does not support findings of the study of Maclagan et al (1999), which suggested that PRICE was becoming less stigmatised for female professionals than for males, but it does show that social information is a significant factor in the pronunciation of PRICE.

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Appendix 1

Table 1: Coefficient table for model of Euclidean distance

	Value Std.	Error	t	Pr(>|t|)
Intercept	889.53	33.72	26.382	0.0000000
Gender=M	-157.43	38.82	-4.056	0.0000695
Class=P	77.73	38.82	2.002	0.0464760

Table 2: Anova table for model of Euclidean distance

Factor		d.f.	Partial SS	MS	F	P
Gender		1	1375345.0	1375345.04	16.45	0.0001
Class		1	335253.6	335253.64	4.01	0.0465
REGRESSION		2	1722861.7	861430.83	10.30	0.0001
ERROR		219	18311331.1	83613.38		

Table 3: Coefficient table for Euclidean distance model combining social factors

	Value Std.	Error	t	Pr(>|t|)
Intercept	817.68	37.86	21.5978	0.0000000
Gender=M	-16.25	53.07	-0.3062	0.7597590
Class=P	221.43	53.54	4.1358	0.0000505
Gender=M * Class=P	-284.89	75.39	-3.7791	0.0002032

Table 4: Anova table for Euclidean distance model combining social factors

Factor	d.f.	Partial SS	MS	F	P
Gender (Factor+Higher Order Factors)	2	2501191	1250595.3	15.86	<.0001
All Interactions	1	1125846	1125845.6	14.28	<.0001
Class (Factor+HOF)	2	1461099	730549.6	9.27	1e-04
All Interactions	1	1125846	1125845.6	14.28	2e-04
Gender * Class (Factor+HOF)	1	1125846	1125845.6	14.28	2e-04
REGRESSION	3	2848707	949569.1	12.05	<.0001
ERROR	218	17185486	78832.5		

Table 5: Coefficient table for nucleus F2 combining social factors

	Value Std.	Error	t	Pr(>|t|)
Intercept	398.255	18.44	21.5975	0.0000000
Gender=M	4.254	25.85	0.1646	0.8694225
Class=P	90.673	26.08	3.4770	0.0006119
Gender=M * Class=P	-93.272	36.72	-2.5403	0.0117728

Table 6: Anova table for nucleus F2 combining social factors

Factor	d.f.	Partial SS	MS	F	P
Gender (Factor+Higher Order Factors)	2	218423.1	109211.55	5.84	0.0034
All Interactions	1	120680.1	120680.05	6.45	0.0118
Class (Factor+HOF)	2	226281.6	113140.81	6.05	0.0028
All Interactions	1	120680.1	120680.05	6.45	0.0118
Gender * Class (Factor+HOF)	1	120680.1	120680.05	6.45	0.0118
REGRESSION	3	325855.2	108618.42	5.81	0.0008
ERROR	218	4076922.9	18701.48		

Table 7: Coefficient table for nucleus F1 combining social factors

	Value Std.	Error	t	Pr(>|t|)
Intercept	605.96	14.46	41.897	0.000e+00
Gender=M	-122.75	20.27	-6.055	6.082e-09
Class=P	-25.05	20.45	-1.225	2.219e-01
Gender=M * Class=P	77.66	28.80	2.697	7.551e-03

Table 8: Anova table for nucleus F1 combining social factors

Factor	d.f.	Partial SS	MS	F	P
Gender (Factor+Higher Order Factors)	2	477691.3	238845.66	20.76	<.0001
All Interactions	1	83665.9	83665.90	7.27	0.0076
Class (Factor+HOF)	2	94729.7	47364.85	4.12	0.0176
All Interactions	1	83665.9	83665.90	7.27	0.0076
Gender * Class (Factor+HOF)	1	83665.9	83665.90	7.27	0.0076
REGRESSION	3	489966.5	163322.18	14.20	<.0001
ERROR	218	2508106.1	11505.07		