REGIONAL VARIATION IN THE VOWELS OF FEMALE ADOLESCENTS FROM SYDNEY

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ABSTRACT

This paper examines the assumption that Australian English vowel variation within urban centres is restricted to broadness variation and is a consequence of socioeconomic rather than regional factors. The acoustic structure of vowel realisations for subjects across three different regions in Sydney is compared to shed some light on the theory of regional uniformity. 95 adolescent female speakers of General Australian English produced multiple repetitions of 18 different vowels in the h-d context. The vowel formants for each group were compared using ANOVA with *post-hoc* Bonferroni. Results revealed several significant area effects not necessarily associated with broadness variation. As area often subsumes a range of socioeconomic factors, it was necessary to also investigate whether some other socioeconomic indicator would account for the results. An examination of parental occupation, education and area confirm area as the most important of these factors in influencing vowel realisation for this group of speakers.

1. BACKGROUND

In this paper we will address the issue of accent homogeneity in a large urban centre in Australia. We will provide evidence to question the uniformity hypothesis, which has remained largely unchallenged for Australian English, by showing that there are several significant vowel differences between groups of talkers from regionally distinct areas in Sydney. We will also show that these vowel differences cannot be considered a consequence of socioeconomic effects.

In our previous work we have examined the acoustic structure of Australian English vowels and have established the phonetic properties of vowels associated with the three accent types: Broad, General and Cultivated Australian. Our analyses have concentrated on present day speakers (Harrington, Cox and Evans, 1997) but we have also re-examined accent data from the 1960s (Cox, 1996; Cox, 1998). The results of these studies describe in detail the acoustic vowel characteristics of the accent categories for males and females and confirm that accent effects present in the 1960s prevail. We have also investigated vowel change through a trend analysis which involved a comparison of present day data with data from the 1960s (Cox, 1996) and have suggested several vowels which are in the process of change (Cox, submitted). To further assess the phenomenon of vowel change and to validate the results of our trend analysis we have conducted an apparent time analysis where age related characteristics were investigated (Cox and Palethorpe, 1997).

The present paper aims to further our investigation of Australian English vowels by examining differences in formant frequency values between groups of speakers from three different regions in Sydney. The rationale for this study relates to the traditionally held belief that the Australian English accent is regionally homogeneous and variation that is present is restricted to the sociostylistic broadness continuum (Ingram, 1989). Any previously noted regional effects in Australian English have been described with reference to relative proportions of speakers from each of the three accent categories who comprise the population of a particular area. For instance, there is past evidence for a greater prevalence of Broad speakers in country areas than in the cities (Mitchell and Delbridge, 1965). The assumption of regional homogeneity has been implicit in our prior analyses where accent type alone was included as a variable to be investigated. Therefore, regional aspects were overlooked because we considered such characteristics subsumed under accent type. Comparisons between the results of our apparent time and real time analyses of vowel change have uncovered some inconsistencies which can be accounted for by examining in more detail the characteristics of our sample populations. The possibility of regional influences in our data has led us to question the validity of the homogeneity theory and therefore a study of regional effects is warranted to more fully characterise Australian English vowels and to help explain the apparent inconsistencies in the results of previous research.

The following paper explores the issue of regional uniformity in urban centres by comparing the formant structure of vowels produced by groups of adolescent female talkers from three different regions in Sydney.

2. ANALYSIS 1

2.1. Methodology

Speech data was collected from 95 second generation Australian females from Sydney comprising 27, 15 year-olds from the Western suburbs (Western), 44, 15 year-olds from the Northern Beaches (Beaches), and 24, 15-25 year-olds from the Northern Suburbs (Northern) of Sydney. All speakers had lived in their designated area for at least ten years and were classified as speakers of General Australian English according to criteria suggested by Mitchell and Delbridge (1965).

Speakers read 18 Australian English vowels in the fully stressed h-d context in citation form from flash cards four to five times in random order. The Beaches, Western and the majority of Northern subjects were recorded in a quiet room in their schools using a portable Marantz CP430 cassette recorder and a Beyer M88 dynamic microphone. The remaining Northern speakers were recorded using an AKG C414EB condenser microphone in a sound treated studio in the Speech Hearing and Language Research Centre directly to DAT tape.

The speech data was sampled at 20 kHz with 16 bit resolution and each vowel was analysed using the ESPS/Waves+ system (Entropic Research Laboratory Inc.). The first four formants were automatically tracked using a 12 pole autocorrelation LPC with a 49 millisecond raised cosine window and frame shift of 10 milliseconds. The accuracy of each formant trace was checked by hand and manually modified on the screen where necessary.

The single target of the monophthongs and the two targets for the diphthongs were established for all vowels excluding /ɪə/ and /eə/ following standard criteria as detailed in Di Benedetto (1989). Measurements of the centre frequencies of the first two formants were made at the established target(s). The target formant values from multiple tokens of the same word for an individual speaker were averaged prior to statistical analysis. A oneway ANOVA with *post-hoc* Bonferroni tests was used to examine the effect of the independent variable, AREA, on the dependent variables, formant one (F1) and formant two (F2). An F probability criterion of .01 was selected for statistical significance.

Vowel	Formant	*df*	*F* ratio	*F* prob.
e	F1	2,93	6.66	.002
æ	F1	2,93	8.94	.000
ɔ	F1	2,92	13.53	.000
ɔ	F2	2,92	8.41	.000
ʊ	F2	2,93	15.45	.000
ɜ	F1	2,93	5.52	.005
aɪ	F1T1	2,93	6.55	.002
aɪ	F2T1	2,93	9.98	.000
ɔɪ	F1T1	2,93	6,71	.002
oʊ	F1T1	2,92	6.70	.002
oʊ	F2T1	2,92	9.62	.000
aʊ	f1T1	2,93	8.57	.000

Table 1: Results of the oneway ANOVA comparing area groups

2.2. Results

The results will be discussed with reference to the phonetic dimensions of height and fronting and are illustrated here by means of ellipse plots presented in the standard F1/F2 plane with axes oriented to replicate the traditional vowel map.

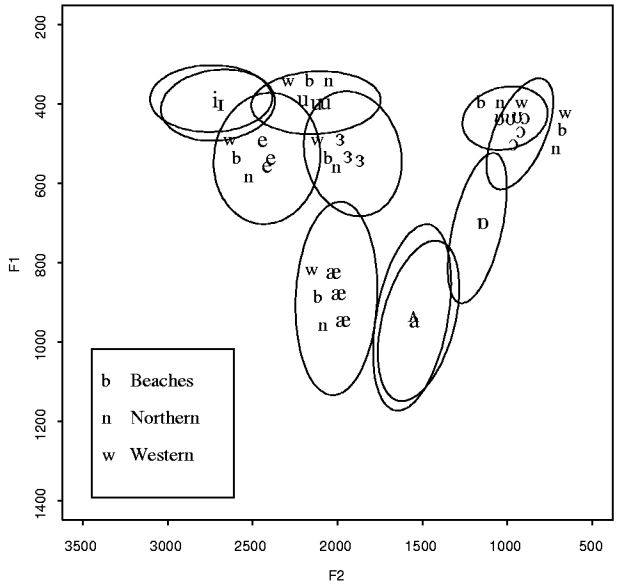

Figure 1: Vowel monophthong targets for the three area groups.

The ellipses for the following plots have been derived from the entire complement of subjects and represent a range of two standard deviations from the mean for each vowel. The individual centroids for each group are defined only for those vowels shown to exhibit a significant main effect for AREA.

A large number of significant effects are present in the data. In all cases the Western group differs significantly from the other two. Table 1 provides the results of the ANOVA and Figure 1 illustrates the differences for monophthongs. Vowels that are phonetically raised in the Western group relative to the Beaches and Northern groups are /e, æ, ɔ, ɜ/. The Western group has retracted /ɔ/ and /ʊ/ and in fact displays very little formant pattern difference between these two vowels. We have included the centroids for /u/ in this plot as a more fronted realisation for the Western group is clear. This difference is not significant in the present analysis due to very large standard deviations for the Northern and Beaches groups.

Diphthongs also display several AREA effects with most restricted to the first target. The diphthong plots illustrate target one (T1) to target two (T2) trajectories for each area group superimposed on the average monophthong vowel space. The area group labels are placed at the first target. For /aɪ/, the first target is significantly higher and more retracted for the Western group relative to the Northern and Beaches groups (see Figure 2).

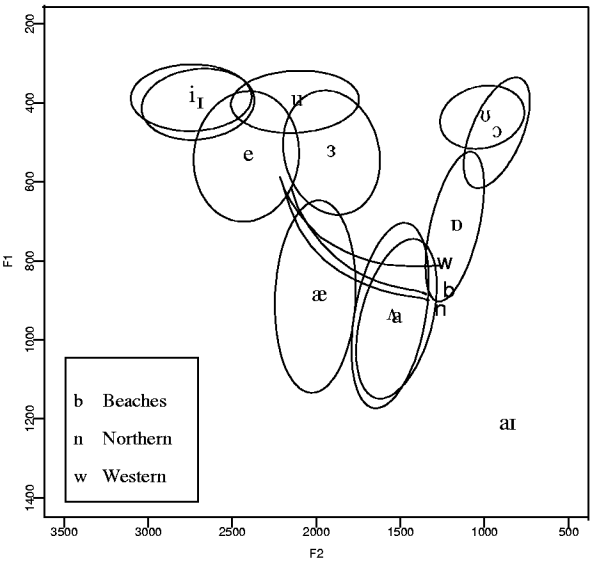

Figure 2: /aɪ/ trajectories for the three area groups superimposed on the monophthong target space.

The first target of /ɔɪ/ is higher for the Western group relative to the Beaches group (Figure 4). This raised first target parallels the raising of /ɔ/ shown in Figure 1. The first target of /oʊ/ is more fronted for the Western group relative to the other two groups but there is also a difference of height (Figure 3). For /aʊ/, the first target is raised for the Western group relative to the Beaches and Northern groups (Figure 4). The raised first target parallels the raising of /æ/ shown in Figure 1.

2.3. Discussion

The area effects are clearly present in the data revealing that the Western group displays a spatial vowel arrangement that differs from that of the Northern and Beaches subjects. This relates not only to the monophthongs, particularly /e, æ, ʊ, ɔ, ɜ/ but also to the diphthongs /aɪ, ɔɪ, oʊ, aʊ/. There is evidence for the close interrelationship between monophthongs and diphthongs in phonetic space

as has been discussed in out previous work (Cox and Palethorpe, 1997; Cox, 1996; Cox, 1997).

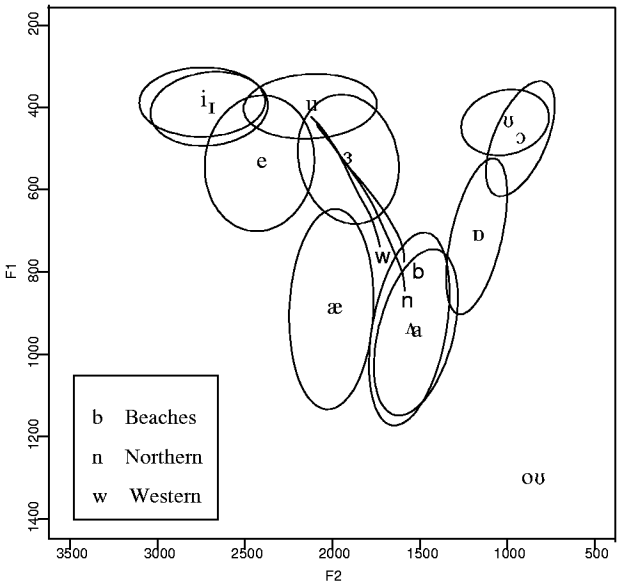

Figure 3: /oʊ/ trajectories for the three area groups superimposed on the monophthong target space.

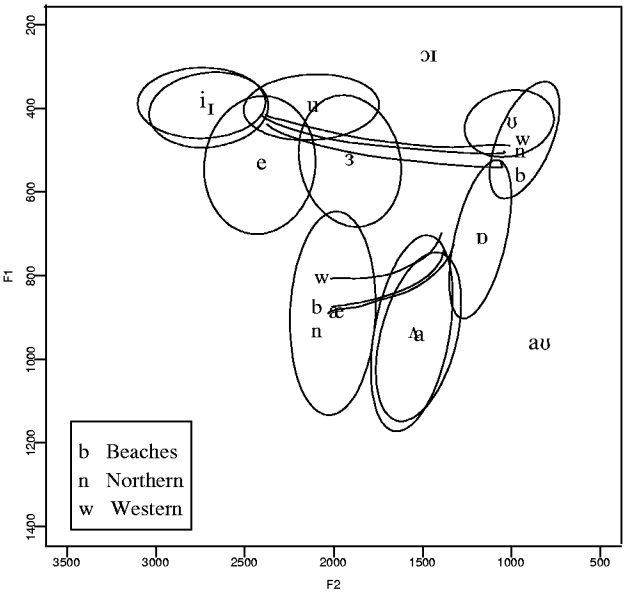

Figure 4: /aʊ/ trajectories for the three area groups superimposed on the monophthong target space.

Some of the diphthong differences are suggestive of broadness variation despite the fact that accent type was controlled in this study and restricted to General Australian English. However, as broadness variation manifests as a continuum of phonetic variation, it is not surprising to find variation within this large General category. Cox (1998) and Harrington, Cox and Evans (1997) found that the most significant broadness characteristics were associated with the first targets of diphthongs, specifically the retraction and raising of /aɪ/, the fronting and raising of /aʊ/ and the lowering and retraction of /eɪ/. The present data shows variation similar to that displayed along the broadness continuum for the vowels /aɪ/ and /aʊ/ and the Western group displays broader realisations for these vowels. Given the assumption that broadness variation is related to socioeconomic categories, one question that we may ask of these results is whether the differences described here are an actual consequence of region as suggested or whether some other factors differentiate the speakers in this study. The aim of the following analysis is to ascertain whether socioeconomic factors account for the results obtained above.

3. ANALYSIS 2

3.1. Methodology

For the second analysis, socioeconomic data collected for the Beaches and Western subjects were examined along with AREA to establish which variables best accounted for the differences between groups. The Northern group has been excluded from this analysis as social data was not available for a sufficient number of group members. Socioeconomic indicators used were mothers' and fathers' educational level of attainment (MED and FED) and socioeconomic group (SEG), categorised as working class (WC), upper middle class (UMC) and lower middle class (LMC). The SEG categories were ascertained through a rating of Mothers' and Fathers' occupational prestige (Daniel, 1982). These variables (MED, FED and SEG) were individually examined in combination with AREA to determine the effect on the dependent variables, F1 and F2. The Western speakers were categorised as 13% UMC, 48% LMC, 39% WC and the Beaches speakers were categorised as 31% UMC, 57% LMC and 11% WC.

A series of twoway ANOVAs with *post-hoc* Bonferroni tests was conducted for each formant of each vowel for AREA and SEG, for AREA and MED, and for AREA and FED.

3.2. Results

The results of the AREA X SEG, AREA X MED and AREA X FED ANOVAs revealed AREA main effects for F1 of /e, æ, ɔ, ɜ/ and F2 of /ɔ, ʊ/. Area effects were also present for target one of /aɪ, ɔɪ, oʊ, aʊ/. All these effects are significant at the .01 level and are the same as those discussed in the first analysis. There were no significant SEG, MED and FED effects at this significance level.

3.3. Discussion

The results of the socioeconomic indicator comparisons, which show no associations between socioeconomic factors and vowel realisation, provide compelling evidence against the idea that vowel realisation is primarily related to socioeconomic factors for speakers of Australian English. It is clear that for this group of subjects AREA is a much more significant variable.

4. CONCLUSIONS

The uniformity theory of Australian English cannot be supported by the results of the present research. We have shown that significant differences pertain to the acoustic characteristics of Australian English vowels produced by regionally distinct speakers within a single urban centre. There differences are not the consequence of socioeconomic characteristics as measured by parents' occupation and educational level of achievement. The differences that have been found for monophthongs have not been previously described as carrying non-linguistic information and

do not constitute those that mark the different Australian English accent types. The only monophthongs whose targets have been previously shown to vary with accent type are /u/ and /ɜ/ (Harrington *et al.*,1997) and /a/ and /ɜ/(Cox, 1998) and these vary in F2. The diphthongs, /aɪ/ and /aʊ/ do provide area information but these vowels also relate to broadness variation indicating that, at least for some vowels, broadness does function to convey area characteristics. It is important to note that not all broadness markers vary according to area for these speakers and also that vowels which have not been previously identified as accent markers, such as /ɔɪ/, have been shown here to display considerable area associations. It may be possible the accent differentiation markers have changed for Australian English and this issue needs to be more fully examined with a larger sample population.

The present results may be explained in relation to group solidarity (Eckert, 1988; Giles, Coupland and Coupland, 1991) where the pressure on adolescents to conform to peer norms may be so strong that it eclipses parental influence. Area effects therefore take precedence because they represent peer effects. Similar results were shown to be present in Cox (1996).

The results of this study have implications for the control of speaker characteristics in Australian phonetic research. The recruitment of subjects from different regions without question may introduce a confounding variable that could affect the research outcomes.

A more comprehensive picture of contemporary Australian English would be obtained by examining a more diverse group of speakers. It is also important to extend the studies to include both sexes as we cannot assume gender comparability for social or regional characteristics. There are, of course, other phonetic vowel factors that carry potential non-linguistic information, such as onglide for /i/ and /u/ (Harrington *et al.*, 1997), durational aspects (Bernard, 1967; Cox, 1996), and also the differential effects of a wider range of consonantal contexts. Our future research in this area will examine these factors.

The present study provides evidence that speakers from different parts of Sydney make use of area specific vowel realisations that are not associated with social indicators such as parental occupation and education. These results call into question traditional notions regarding Australian English as a regionally homogeneous dialect exhibiting social variation restricted to the Broad, General, Cultivated continuum.

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