An acoustic comparison of Australian and New Zealand English vowel change

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Abstract

This paper presents an acoustic description of changes occurring in the front lax vowels of Australian English (AE) over a forty year period. It contrasts these to the changes in the equivalent NZE vowels over the same time period. Results suggest that during this period, AE and NZE front lax vowels have been diverging from previously similar productions, with a greater shift apparent in NZE vowels than in AE vowels.

1. Introduction

Recent acoustic studies have shown that the AE /ɪ/ is considerably higher and more fronted than the NZE /ɪ/ (Evans, 2003; Maclagan, 1982; Watson, Harrington and Evans, 1998), and that the /e/ and /æ/ are lower in AE than in NZE (Maclagan, 1982; Watson *et al* 1998a). But when did these changes take place? Are they only a comparatively recent phenomenon, or do they reflect a more longstanding variation between these two antipodean dialects?

While the settlement of Australia occurred 40 years prior to that of New Zealand, early impressionistic accounts suggest that AE and NZE were initially (at least superficially) similar. They were both considered to be "pure" dialects - that is, lacking in regional phonetic markers - unlike many of those found in the British Isles (Hammarström, 1980; McBurney, 1887). When they diverged from the British Received Pronunciation (RP), they did so in similar ways. For example, in the late 1800s through to 1900, diphthongs in both AE and NZE were considered to be close to Cockney English production (Gordon, 1983; McBurney, 1887). And in the early 1900s, both NZE and AE /æ/ and /e/ appeared to be more raised, and /aː/ more fronted when compared with the RP equivalents (Baker, 1966; Gordon, 1983; Mitchell and Delbridge, 1965; Turner, 1970).

Between these observations of AE/NZE similarity, and the differences observed in the modern day AE and NZE vowel spaces (documented above), substantial changes have obviously occurred. Changes to NZE over time have been well documented. Watson, Maclagan and Harrington (2000), Maclagan (2000) and Maclagan and Gordon (2004), for instance, have described changes to the NZE vowel space over a 50 year period. Their results have showed that (among other changes) the NZE /ɪ/ has centralised, and the /e/ and /æ/ vowels have raised substantially in this time. Further research by Maclagan and Hay (2004) suggests that the NZE /e/ vowel may now be of a similar height and fronting to NZE /iː/. On the other hand, changes to the AE vowel space have been less extensively documented: Cox (1996), in a comparison of 1960s and 1990s AE vowel data, showed that over a thirty year period, AE /æ/ has lowered, and /ɪ/ has become more fronted.

The impressionistic evidence suggests that in undergoing these changes, AE and NZE have been diverging from previously similar productions. Maclagan and Gordon (2004), certainly acknowledge the possibility of AE influencing the early development

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of NZE. In the present research, arising from previous research by Evans (1998), we will use acoustic evidence to ascertain whether the front lax vowel spaces in AE and NZE have been diverging from similar productions, or whether these vowel spaces have been disparate even from the early years of settlement.

2. Methodology

2.1. Speakers

Vowel tokens were collected from four groups of speakers: Early AE, early NZE, modern AE and modern NZE. Data for three of these groups were taken from previous studies. The early NZE data was taken from recordings made by a mobile radio unit in the late 1940s for the purpose of recording the history and culture of the country (Maclagan and Gordon, 2004; Watson *et al* 2000). The modern NZE data was recorded as part of the Otago database in 1995 (Sinclair and Watson, 1995). The modern AE data was taken from the Australian National Database of Spoken Language (ANDOSL), recorded in the early 1990s (Millar, Vonwiller, Harrington and Dermody, 1994). The early AE data was collected specifically for the current experiment.

Since each of the three existing databases were created independently, the methods of recording and collecting the speech data varied across them. The data from these existing databases therefore needed to be carefully selected in order to ensure that for each of the two time periods (early and modern), the speakers were as similar as possible (i.e. of a similar age and comparable backgrounds), and the vowel tokens were taken from similar speech styles (e.g. continuous speech vs isolated word lists). In the modern data, therefore, the AE speakers were selected from the ANDOSL to match the Otago speakers. That is, the Otago speakers were all aged between 16 and 33, they were not classified according to broadness of accent, and the vowel tokens were all elicited in isolated words. As a result, the modern AE speakers were selected from the 'young' group of the ANDOSL database (18-30), included all accent types (broad, general and cultivated), and the vowel tokens were taken from only the isolated word section of the corpus.

A similar strategy was used for the early data. Since no corpus of early AE data existed to match that of the NZE mobile radio unit data, it was necessary to collect a group of speakers recorded at approximately the same time (late 1940s), who were of a similar age at the time of recording (early-mid 50s), and who produced a similar type of speech (continuous). A thorough search of the Australian Archives yielded nine speakers who fitted these criteria. Owing to the need to establish background information (such as the age) of the AE speakers, it was necessary to select recordings from moderately prominent personalities (for more details, refer to Evans, 1998). As a result, the continuous speech produced by the early AE speakers was either a read passage or rehearsed political broadcast, compared with the informal responses to interview prompts elicited in the early NZE data. Table 1 summarises the number of speakers in each group, and the age ranges of those speakers.

Table 1: Number of speakers and age ranges for early and modern AE and NZE speakers

	AE		NZE	
	Number	Age	Number	Age
Early Male	6	60-65	2	51-54
Early Female	3	60-65	2	51-54
Modern Male	20	18-30	11	16-33
Modern Female	21	18-30	10	16-33

2.2. Materials

Vowel tokens from the modern AE data were all produced in an /hVd/ context in isolated words. Each vowel was produced only once by each speaker. In the modern NZE data, each vowel occurred in three different words (see Sinclair and Watson (1995) for details), and each word was repeated three times.

In the continuous speech of the early AE and NZE data sets, tokens were extracted only from the lexically stressed syllable of accented words, and were not included for analysis if they preceded an approximant. The formant values for each vowel were extracted at the acoustic target (i.e. the point in the vowel at which the formant values showed minimal movement, generally at either a peak or trough in the F1 or F2 value). Table 2 shows the total number of vowel tokens used for each of the groups (shown separately for male and female speakers).

Table 2: Number of AE and NZE vowel tokens

	AE			NZE		
	/ɪ/	/e/	/æ/	/ɪ/	/e/	/æ/
Early Male	193	329	298	51	50	59
Early Female	101	144	93	48	54	49
Modern Male	20	20	20	99	99	99
Modern Female	21	21	21	89	90	89

We acknowledge that comparing vowels extracted from continuous speech data with vowels from isolated word data is problematic, not only due to the uncontrolled phonetic context in continuous speech, but also because vowels undergo considerable reduction in continuous speech (Lindblom, 1963). In this case, directly comparing formant values is unlikely to yield useful

information. Instead, a relative comparison of vowel positions may help to reveal the changes in the AE and NZE front vowel spaces. In order to provide a point of reference, the vowels /oː/, /ɔ/ and /ɐ/ were included in the analysis. According to Cox (1996), the /oː/ vowel has shown very little movement in AE over the last 30 years. Furthermore, acoustic evidence from Watson *et al* (1998b) indicates that /oː/ and /ɔ/ show very little F1/F2 variation across modern AE, NZE and British English. As such, it was assumed that these were stable vowels, and hence reliable reference points from which to judge the movement of the front vowels.

3. Results

Given that many of the comparisons involve vowel tokens from both continuous and isolated word speech, the results here will describe observable trends in the data, rather than performing analyses of statistical significance. The vowels displayed in these results are the HID, HEAD, HAD, HUD, HOARD and HOD vowels. These will be represented in the formant plots by the phonetic symbols /ɪ e æ ɐ oː ɔ/ respectively.

3.1. Early AE and Modern AE

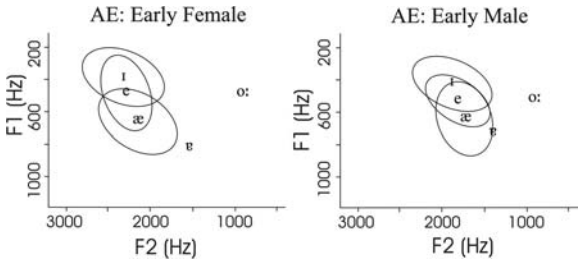

Figure 1: F1 and F2 ellipse plots showing means and 2.45 standard deviations from the mean for early female (left) and male (right) AE speakers.

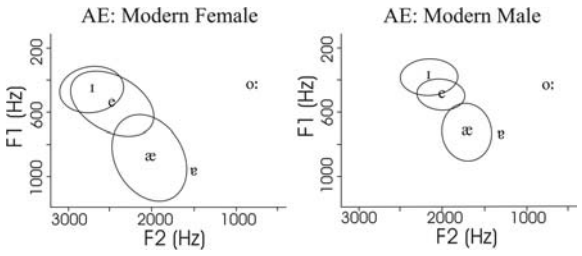

Figure 2: F1 and F2 ellipse plots showing means and 2.45 standard deviations from the mean for modern female (left) and male (right) AE speakers.

Figure 1 shows that in both the male and female early AE data, /ɪ/ has a slightly higher F2 value than /e/, and /e/ has a higher F2 value than /æ/. For the male speakers, the /e/ vowel was produced with an F1 value closer to that of /æ/ than /ɪ/, whereas for the female speakers the reverse was true: in this case, /e/ was produced with an F1 more similar to that of /ɪ/.

In relation to /oː/, figure 1 shows that both male and female early AE speakers produce /e/ with a similar F1 value to the back vowel, but produce /ɪ/ with a slightly lower F1 value than /oː/.

Figure 2 shows that within the lax vowel set /ɪ e æ/, as F1 decreases, F2 increases for both male and female modern AE speakers. The higher F2 of /ɪ/ in relation to /e/ appears to be slightly greater for the female speakers than for the male speakers, and for both male and female speakers, the /e/ centroid is closer to /ɪ/ than to /æ/.

In comparison to the more stable /oː/, the /e/ for both sexes had a slightly higher F1 value than /oː/, a difference that was more pronounced for female speakers than for male speakers, while the /ɪ/ had either a similar F1 to /oː/ (female), or a slightly lower F1 (male).

3.2. Early AE and NZE

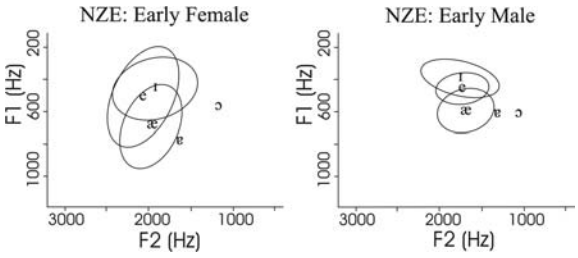

Figure 3: F1 and F2 ellipse plots showing means and 2.45 standard deviations from the mean for early female (left) and male (right) NZE speakers.

Unfortunately, the /oː/ vowel was not available for the early NZE data, so /ɔ/ was used in its place. However, the F1 and F2 values of /ɔ/ also appeared to vary considerably between speakers, so while it is included in Figure 3, it has limited usefulness as a stable point of reference. From figure 3 it can be seen that /e/ had a slightly higher mean F2 value than /æ/ for both male and female speakers (although this difference was negligible in the male data). In the male data, /ɪ/ shows very little difference in mean F2 compared with either the /e/ or /æ/ vowels, whereas in the female data, the /ɪ/

F2 mean is noticeably higher than the /e/ F2 mean, and very slightly higher than the /æ/ F2 mean. For both male and female speakers, the mean F1 value is progressively lower for the three front vowels /æ/, /e/, and /ɪ/.

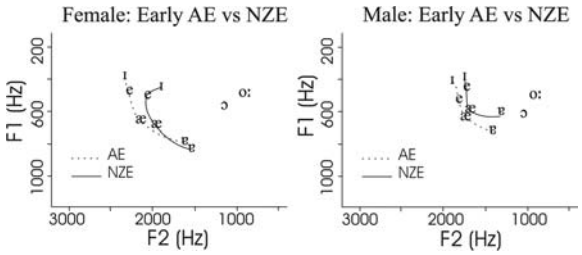

Figure 4: Comparison of F1 and F2 means for early female (left) and male (right) AE and NZE speakers

Figure 4 shows a comparison of the early AE and NZE F1 and F2 means. From this figure, it can be seen that the NZE and AE males showed a generally similar arrangement of the vowel space. In both accents, /æ/ has a lower F1 than /ɐ/, and the /ɪ/, /e/ and /æ/ vowels are all progressively raised and fronted with respect to each other. The only difference worth noting in the male data is the relative position of /e/ with respect to the two flanking vowels /ɪ/ and /æ/: in the AE data, /e/ appears to be located midway between /ɪ/ and /æ/, whereas in the NZE data, /e/ is located closer to /ɪ/. Greater differences are evident between the female AE and NZE speakers. Generally speaking, the AE and NZE females produced the vowels /ɐ/, /æ/ and /e/ with the same pattern of increased F2 and decreased F1 (i.e. /æ/ has a higher F2 and lower F1 in comparison with /ɐ/, and a similar pattern is seen with /e/ in contrast to /æ/). However, the production of /ɪ/ differs notably across the two accents. Where the AE /ɪ/ was produced by female speakers with a lower F1, and slightly higher F2 (in contrast to /e/), the NZE female speakers produced this vowel with a markedly lower F2 mean in comparison with their /e/ production. Moreover, while the NZE females produced /ɪ/ with a lower F1 mean in comparison with their /e/, the F1 difference between these vowels did not appear to be as great as that between the AE /ɪ/ and /e/ vowels.

3.3. Modern AE and NZE vs Early AE and NZE

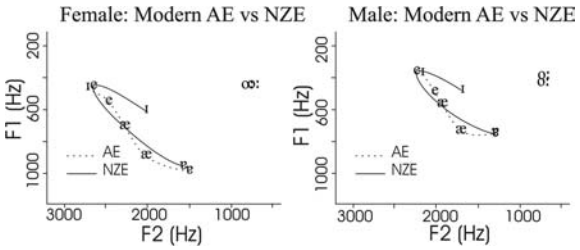

Figure 5: Comparison of F1 and F2 means for modern female (left) and male (right) AE and NZE speakers

Figure 5 indicates considerable differences between F1 and F2 values in the AE and NZE front vowel spaces. These differences appear to be very similar both male and female speakers. For instance, the NZE /e/ has similar F1 and F2 values to the AE /ɪ/, and the NZE /æ/ is roughly midway between the AE /e/ and /æ/ vowels (in the male data the NZE /æ/ lies slightly closer to the AE /e/, which may either indicate that the male NZE /æ/ has a lower F1 value in contrast with the female /æ/, or that the female AE /e/ has a lower F1 value in comparison with the male AE /e/). For a more comprehensive description of variation in the modern AE and NZE vowel spaces, the reader is referred to Watson *et al* (1998a).

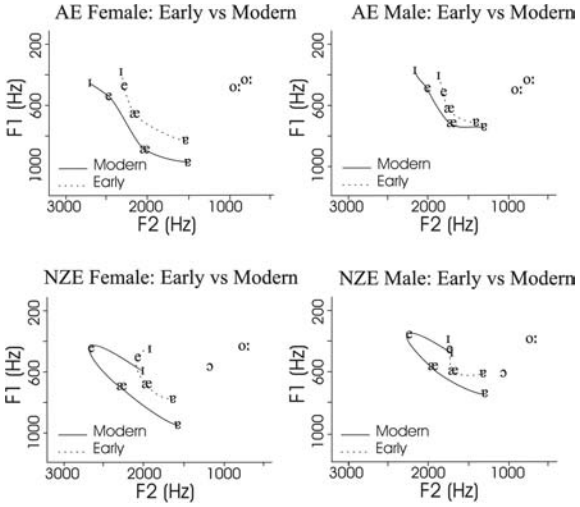

Figure 6: Comparison of AE (top) and NZE (bottom) F1 and F2 means for female (left) and male (right) modern and early speakers.

Figure 6 shows a time-wise comparison of the vowel spaces for both AE and NZE speakers. It is important to keep in mind here that since the vowel tokens in the early and modern data sets were taken respectively

from continuous speech and isolated words, it is impossible to directly compare formant values. Instead, the relative positions of the vowels within their own vowel spaces will be compared.

Figure 6 shows firstly, that there seem to have been few changes between the early and modern productions of the AE front vowels. The data shows that /e/ and /oː/ have maintained a similar height in relation to one another. This is a useful anchor point to make the movements of the other front vowels a little clearer. For example, in the early male data, /e/ was located midway between /ɪ/ and /æ/, whereas in the modern data, /e/ is much closer to /ɪ/. Since /e/ has maintained its height with respect to /oː/, it is relatively safe to assume that the change in the /ɪ/, /e/ and /æ/ relative locations is due to the shifting of either /ɪ/ or /æ/. Such an assumption is substantiated in acoustic evidence from Cox (1996), who has shown that /æ/ has lowered in AE over a 25 year period. This type of change is also apparent in our female data. The only other marked change in the AE data is the fronting of /ɪ/. In both male and female early AE data, the /ɪ/ is located almost directly above the /e/ vowel, whereas in the modern data, it has a noticeably higher F2 value in comparison to /e/.

The changes to NZE over time have been much more extreme. (see Watson, *et al* (2000) for more information). In the early NZE data, for example, the /e/ vowel has a similar or only slightly higher F2 value in comparison to the vowels /æ/ and /ɪ/, whereas in the modern data, the F2 of /e/ is considerably higher than that of both /æ/ and /ɪ/. There is also considerable vowel re-arrangement on the F1 axis. In the early NZE data, both male and female speakers produced the /ɪ/ vowel with the lowest F1 value (in comparison with /e/ and /æ/ F1 values). In the modern data however, the positions of the /e and /ɪ/ vowels appear to be reversed with respect to F1: /e/ is produced with the lowest F1, /æ/ with the highest, and /ɪ/ with an F1 that falls between these two vowels.

Discussion

The results show that AE front lax vowels have changed relatively little over time when compared with their NZE equivalents. Where all three of the front lax vowels have shown quite substantial changes in NZE over a fifty year time period, only the /ɪ/ and /æ/ vowels in AE have shown noticeable movement. Moreover, the extent of vowel shift appears to be less in AE than in NZE, for example, the fronting of AE /ɪ/ does not appear to be as extensive a change as the retraction/lowering of NZE /ɪ/.

Regarding change in the AE front lax vowel space, the relatively stable /e/ vowel in AE has provided a useful point of reference in ascertaining vowel shift. For instance, the increase in F1 distance between /e/ and /æ/ in AE is more likely to be due to the lowering /æ/ than to the raising of /e/. This inference is reinforced by previous longitudinal data collected by Cox (1996) who found that /æ/ has been lowering between 1960 and 1990. The 1960s data, as analysed by Bernard (1970) showed that in terms of F1, /e/ was closer to /ɪ/ than /æ/. This suggests that /æ/ may already have been lowering from a previously higher position in the early AE data displayed in this research (where the F1 of /e/ is roughly equidistant between the F1 for /æ/ and /e/ for the male speakers). Our data combined with the data displayed by Cox (1996) therefore suggests that AE /æ/ has been lowering from a much higher position over a 50 year period at least. The early AE data also suggests that much of the /ɪ/ fronting occurred post-1950s. In both the male and female early data, the /ɪ/ is produced with a similar F2 value to /e/, whereas in the modern data, there is a marked increase in F2 in /ɪ/ in comparison to /e/ for all AE speakers.

In contrast the AE data, the NZE speakers show a much more marked change in vowel production over time. It is difficult, however, to interpret the precise nature of this vowel shift, due to the high mobility of all the NZE vowels involved. A cursory examination of the NZE data suggests that the major changes occurring between the 1940s and 1990s were the raising and fronting of /e/, and the centralisation of /ɪ/. Figures 4 and 5 show the NZE vowel space against the more stable AE vowel space. From these figures, it is apparent that the greatest movement in the NZE vowel space occurred with the fronting and raising of /e/. In the early NZE data (figure 4), the /e/ vowel is located at about the same height (female) or slightly higher (male) than the AE /e/. In both cases it is also more retracted than AE /e/. In the modern data (figure 5), the NZE /e/ is markedly higher and considerably more fronted than the AE /e/. This single shift of the NZE /e/ vowel is likely to have resulted in the substantial redistribution of the NZE front vowel space as seen in the modern-day data. The findings in this study therefore confirm those of previous acoustic studies which have shown that NZE /e/ has played a significant role in the redistribution of the front lax vowel space (Maclagan 2000; Watson *et al*, 2000).

Finally, in comparing NZE and AE across time, it is apparent that in the 1950s there were considerable

similarities between the front vowels of the two accents. Over the subsequent 45 years, these vowels in AE and NZE underwent a marked divergence. In order to determine whether the two accents were diverging from an even more similar production, it is necessary to consider other factors influential in phonetic change. For example, if – as previous research suggests (Maclagan, 2000; Trudgill, 1983) – female speakers are at the forefront of phonetic innovation, the early NZE female speakers may have been innovating the retracted /ɪ/ in the early NZE data, since there is little evidence of /ɪ/ retraction in the early NZE male data. This possibly is indicative of an NZE /ɪ/ production that was originally less retracted than that seen in the early female NZE data, and more like that seen in the early NZE male data.

4. Conclusions

The present study is limited, in that we cannot expect to plot an accurate trajectory of AE and NZE vowel change over any time period from only two points. Instead, we are left to infer the trajectory between these points.

However, for all its limitations, the results of this study confirm previous findings regarding changes in the front lax vowels of AE and NZE. Moreover, regarding the origins of AE and NZE, it is apparent from the available evidence that in the early to mid 1900s, the two accents showed considerable similarity. Whether this similarity eventuated after years of phonetic variance, or whether the Australian accent had a considerable influence on the development of the New Zealand accent in the earliest years of colonisation, is a question likely to remain unanswered.

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