E lowering in Victoria: Neogrammian change or lexical diffusion?

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Abstract

A sound change is in progress in Australian English that sees some speakers from Victoria lowering and retracting the vowel /e/ when it occurs before the consonant /l/ (for example in a word like shell). This lowering process has the effect of creating a merger between the vowels /e/ and /æ/ in this context. Such a merger means that words like shell and shall are no longer differentiated in production. This study investigates whether the change is exceptionless for speakers taking part in this phenomenon or whether it is limited to certain lexical items. Words containing /el/ produced by five speakers from Victoria who exhibited the /el/-/æl/ merger were examined. The selected words containing /el/ in three different contexts, pre-consonantal (e.g. Melbourne), pre-vocalic (e.g. mellow), and word final (e.g. Mel), were acoustically analysed. These contexts allowed us to objectively examine whether E lowering is linked to the position in the word and the degree of lateral velarisation (a phenomenon affected by phonetic context). The results show no lexical effects with E lowering occurring in the prelateral environment in all words examined. This points to a neogrammian change. Another finding is that, contrary to previous suggestions, this phenomenon does not appear to be strongly linked to degree of lateral velarisation.

Keywords: Sound change, Australian English, phonetics, vowels, lateral, velarisation
Background

There is a sound change taking place in Australian English (AusE) that sees some speakers produce a phonetically lower and retracted /e/ vowel in prelateral phonetic environments. The lateral consonant in English is /l/ which occurs at the beginning of the word leaf and the end of the word feel. The prelateral sound change creates a merger between /e/ (e.g. the vowel in head) and /æ/ (the vowel in had)\(^1\). The result is a loss of contrast between these vowels prelaterally and sees minimal pairs such as Ellen/Alan and Elle/Al成为 homophones for speakers taking part in the change. This phenomenon is a relatively recent development; it was first referred to by Bradley (1989, p. 267), who noted that some speakers from Melbourne tended to retract and lower /e/ prelaterally so “that it is similar to, but backer than, /æ/ before /l/.” By the early twentieth century, Bradley (2004) had noted a near complete merger for these vowels in Victorian speakers. This change is region specific; it has only been reported to occur in the state of Victoria. Cox and Palethorpe (2004) found that teenage girls in a town on the Victorian side of the New South Wales/Victoria border produced /e/ as [æ] prelaterally, whereas speakers of the same demographic in towns on the other side of the border did not. The feature is also a popularly known marker of Melbourne speech (Loakes, Hajek, & Fletcher, 2010a).

The prelateral position is a common environment for the production of sound changes (Labov, 1994). In AusE, laterals in syllable coda position are velarised (Cox, 2012). Velarisation is the process of adding a raised dorsal tongue gesture to the primary alveolar tongue tip gesture. This velarised (dark) /l/ has a strong coarticulatory effect on preceding vowels, with front vowels particularly affected (Bernard, 1985; Cox & Palethorpe, 2004; Lin, 2005).

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\(^1\) The phonemic symbols used in this paper are based on the system outlined in Harrington, Cox, and Evans (1997) for describing Australian English.
It has also been suggested that the increased lowering of /e/ in Victoria is related to an increase in the amount of lateral velarisation by Victorian speakers (Loakes, Hajek, & Fletcher, 2010a). Loakes (2008) compared the speech of Victorians from 2002 with the speech of Victorians from the 1960s and found that the modern speakers produced a much more velarised lateral, which was correlated with increased vowel lowering. Apart from /e/, coarticulatory effects of dark /l/ on preceding vowels have also been reported for /u:/ (the vowel in hoot), /i:/ (the vowel in heat), and /əʊ/ (the vowel in goat) in AusE (Bradley 1989, 2004; Cox, 2012), and a similar merger between /e/ and /æ/ also exists in New Zealand English (NZE) (Thomas & Hay, 2005). It is important to note that prelateral /e/ is somewhat lowered and retracted for most speakers; however, for speakers taking part in this sound change the effect is more extreme. Figure 1 shows spectrograms of the words Ellen and Alan for a speaker who separates prelateral /e/ and /æ/ in their production, whereas the spectrograms in Figure 2 show the same words as produced by a speaker for whom these vowels are merged. As can be seen, the F1 and F2 for the /e/ in Ellen are much closer to each other for the merged speaker than they are for the unmerged speaker. For the merged speaker, the formant structure of the /e/ in Ellen looks almost identical to the /æ/ in Alan.

Thomas (2004) has offered an explanation for the /el/-/æl/ merger in NZE that is grounded in exemplar theory. Similarly, Loakes, Hajek, and Fletcher (2010a) have also appealed to exemplar theory to account for the sound change occurring in Victoria. According to this view, listeners fail to account for the vowel lowering that occurs as a coarticulatory effect of the velarised /l/, and hence perceive and store /el/ tokens as /æl/. This perception of /el/ as /æl/ in turn influences the production of /el/ tokens for these listeners, resulting in their realisation as [æl]. This idea is based on Ohala’s theory of
‘innocent misapprehension’ as the process by which sound change occurs as a result of listeners’ failure to correct for coarticulation leading to misinterpretation of the speech signal (Ohala, 1981). Loakes, Hajek, and Fletcher (2010a, 2010b, 2010c) have conducted a number of perceptual experiments that lend support to this theory, with results suggesting Victorians experience more difficulty discriminating between /el/ and /æl/ tokens than non-Victorians (Loakes, Hajek, & Fletcher, 2010a, 2010b, 2010c). These studies have also suggested that lexical frequency has an effect on listeners’ ability to perceive the differences.

There are generally considered to be two types of sound changes: neogrammariam (or regular sound change) and lexical diffusion. A neogrammariam change refers to a sound change that is regular and exceptionless. That is, the change affects all words that provide the phonetic environment to which the change applies (Osthoff & Brugmann, 1878/1975; Labov, 1994; 2006). A change due to lexical diffusion, on the other hand, affects only certain words, but is not observable in others (de Oliveira, 1991). That is, the change is applied to specific lexical items, rather than to a general phonetic environment. According to exemplar theorists, most, if not all, sound changes proceed lexically, with regular changes eventually spreading through the entire vocabulary (Bybee, 2002; Pierrehumbert, 2002). These lexically based changes are thought to proceed according to word frequency. Frequently used words undergo the change, whereas less frequent words do not.
Figure 1. Spectrograms of the words *Ellen* and *Alan* for an unmerged speaker. Arrows show the vowel targets.

Figure 2. Spectrograms of the words *Ellen* and *Alan* for a merged speaker. Arrows show the vowel targets.

**Aim**

The aim of this project is to examine the extent to which the /el/ - /æl/ sound change occurs for speakers who are taking part in it. We will investigate whether the merger is exceptionless, that is, whether the lowered and retracted vowel occurs in all words that provide the required prelateral environment, or whether it is limited to certain words. An exemplar explanation for the change would predict lexical effects to be observable. On the other hand, a neogrammarian view would expect the change to be observable in all words.
that contain the /el/ environment. It is hypothesised that no lexical effects will be observable, and that /e/ lowering will be present in all of the words. Three different phonological contexts will be examined: word-final /el/, preconsonantal /el/, and intervocalic /el/. While some degree of lowering is expected in all contexts, it is hypothesised that the amount of lowering will be affected by the level of velarisation. While coda /l/ is always velarised in AusE, prevocalic onset laterals generally are not (Cox, 2012). Laterals in intervocalic positions, however, may be ambisyllabic and as such may exhibit some velarisation, though presumably less than coda laterals. It is expected that the intervocalic context will exhibit the least amount of velarisation, and hence less lowering of /e/ than the other contexts.

Method

The data for this experiment were taken from the AusTalk corpus words database (Burnham et al., 2011). Only data from speakers who were schooled entirely in Victoria from ages 5 to 18 were considered. Five speakers who produce preretalateral /e/ as [æ] were first auditorily identified. Audio files of these speakers’ productions of words containing preretalateral /e/ and /æ/ were then extracted from the corpus (see Appendix I for a list of words in each context). These words provided three contexts for the examination of preretalateral /e/: word final /el/ in which the lateral is expected to be strongly velarised, as in the word hell; preconsonantal /el/ in which the lateral is also expected to be strongly velarised, as in the word elbow; and prevocalic /el/ where the following vowel is unstressed, as in the word melancholy; in this context less velarisation is expected due to the ambisyllabic nature of the lateral. Productions by each speaker of words containing /e/
and /æ/ before non-lateral coronal consonants (bet, bat, head and had) were also extracted from the corpus to provide baseline examples of the speakers’ vowels.

The data were analysed acoustically using Praat (Boersma & Weenink, 2014). F1 and F2 at the targets of the vowels /e/ and /æ/ were measured for each word. For vowel sounds there is an inverse correlation between vowel height and F1, and between vowel backness and F2 (Harrington, 2010). Examining F1 and F2 provides an indirect indication of vowel articulation and therefore, allowed us to compare the vowels according to phonetic height and backness. The degree to which the speakers merged the /e/ and /æ/ vowels was enabled by a comparison of the minimal pairs Ellen/Alan and Elle/Al. The F2 values for the lateral consonant /l/ were also measured to allow the amount of velarisation of the lateral to be recorded; strong lateral velarisation is correlated with a lower F2 compared to clear (onset) /l/ (Harrington, 2010).

**Results and Discussion**

Figures 3-7 display each speaker’s F1 and F2 values for the minimal pairs Elle and Al, and Ellen and Alan compared to the speaker’s baseline vowels. As can be seen, Speakers 1 and 4 produce very low /e/ prelaterally as indicated by their F1 values. The other three speakers maintain a degree of contrast; nevertheless, their prelateral /e/ tokens are generally spectrally closer to /æ/ than to /e/ and, as Figure 8 demonstrates, they do not contrast to the extent of an unmerged speaker (see below for a discussion of exceptions). Figures 9-13 show the distribution of /el/ tokens for each speaker, relative to the baseline examples of each speaker’s vowels.
Figure 3. Distribution of /ɛl/ and /æl/ tokens for Speaker 1 in relation to non-prelateral /e/ and /æ/.

Figure 4. Distribution of /ɛl/ and /æl/ tokens for Speaker 2 in relation to non-prelateral /e/ and /æ/.

Figure 5. Distribution of /ɛl/ and /æl/ tokens for Speaker 3 in relation to non-prelateral /e/ and /æ/. 
Figure 6. Distribution of /el/ and /æl/ tokens for Speaker 4 in relation to non-prelateral /e/ and /æ/.

Figure 7. Distribution of /el/ and /æl/ tokens for Speaker 5 in relation to non-prelateral /e/ and /æ/.

Figure 8. Distribution of /el/ and /æl/ tokens for an unmerged speaker in relation to non-prelateral /e/ and /æ/.
It can be seen that Speakers 1, 2, and 4 substantially lower and retract /e/ prelaterally in all of the words that were measured. For these speakers, the sound change appears to be unambiguously regular and to occur in all words that present the phonetic environment. Speakers 3 and 5, on the other hand, do not provide such clear examples of regularity. Both of these speakers produce /el/ tokens that are lowered and retracted; however, both speakers also produce tokens that are somewhat higher and less spectrally similar to /æ/ than the other speakers’ tokens. For Speaker 5, the highest of these are only minimally lower than the lowest baseline /e/ produced by this speaker. The tokens that are highest for both of these speakers are in the words Melancholy, Mel, and Melbourne. Although at first glance this may suggest that a lexical effect is at work, the pattern is also reflected in the tokens of Speakers 1 and 4, albeit less dramatically. Speakers 1 and 4 also produce higher /e/ tokens in these /mel/ words than in the other words, although for these speakers the vowels are still very close to the spectral area of /æ/. Furthermore, for both Speakers 3 and 5 these tokens exhibit substantial retraction, especially so in the case of Speaker 5. If these words were to provide evidence for a lexical effect, it would need to be explained why such significant retraction is present. Rather, it would seem as if the sound change is applied to these words, but that the preceding bilabial nasal has a limiting effect on the degree of lowering of /e/. An alternative hypothesis might suggest these speakers produce /el/ as [æɬ], but that following nasals the vowels in these tokens are raised, as nasals are known to have a raising effect on /æ/ in AusE (Cox, 2012). However, such raising is generally anticipatory, not preservative, and it is also not clear why these words do not result in higher /e/ tokens for Speaker 2. Clearly, further analysis needs to be conducted to determine precisely the effect preceding nasals have on the lowering of /e/, but based on the results reported here it seems that /m/ has a restrictive effect on the degree of
lowering. Despite this effect of the nasal, for all of the speakers examined the sound change is nevertheless evident in some form across all words, suggesting this to be a case of a regular sound change.

Figure 9. Distribution of /el/ tokens for Speaker 1 in relation to non-prelateral /e/ and /æ/.  

Figure 10. Distribution of /el/ tokens for Speaker 2 in relation to non-prelateral /e/ and /æ/.
Figure 11. Distribution of /el/ tokens for Speaker 3 in relation to non-prelateral /e/ and /æ/.

Figure 12. Distribution of /el/ tokens for Speaker 4 in relation to non-prelateral /e/ and /æ/.

Figure 13. Distribution of /el/ tokens for Speaker 5 in relation to non-prelateral /e/ and /æ/.
Figure 14 shows the mean F2 for /l/ indicating the level of velarisation in each context for all five speakers. As can be seen, for all speakers F2 was highest in the intervocalic context, which suggests less velarisation of laterals prevocally. This is in line with the expectation discussed above. As the prevocalic laterals may be functioning ambisyllabically, and hence may display features of both coda and onset, it is no surprise that they exhibit less velarisation than the coda laterals. Loakes, Hajek, and Fletcher (2010a) have suggested that, for some speakers at least, laterals in modern AusE are velarised in all positions. That is, some speakers do not produce clear /l/, but rather produce dark /l/ in all positions. While the present study seeks neither to validate nor reject this assertion, it is clear that for the speakers examined here laterals in coda position are more velarised than laterals in intervocalic position.

Figure 14. F2 means of laterals in intervocalic, word final and preconsonantal contexts.

Despite the reduced level of velarisation for laterals in intervocalic position, only a weak correlation was found between increased velarisation and increased lowering. Figures 15 - 17 display the values of F1 of /e/ in relation to F2 of /l/ for each speaker individually. A high
frequency F1 suggests lowering, while a lower frequency F1 suggests a phonetically higher vowel production. A higher frequency F2 suggests less velarisation of the lateral. As can be seen, there is a tendency for increased lowering with increased velarisation; however, this did not reach significance for any of the speakers (Speaker 1: r = -0.1248; Speaker 2: r = -0.0409; Speaker 3: r = -0.2663; Speaker 4: r = -0.2533; Speaker 5: r = -0.4712). In addition, some of the vowels in the intervocalic context, which exhibited less velarisation, were nonetheless realised as phonetically lower than other tokens produced by the same speaker that were word final or preconsonantal and exhibited more velarisation. The lowest /e/ produced by Speaker 1, for example, occurs in the intervocalic context. Similarly, Speakers 2, 4, and 5 all produce their phonetically highest realisations of /e/ in either the word final or preconsonantal context, that is, in contexts that exhibit more lateral velarisation. These results are indeed surprising, as the lowering effect of dark /l/ on preceding vowels is, as discussed above, well attested. Furthermore, this sound change has been linked to increased lateral velarisation (Loakes, Hajek, & Fletcher, 2010). It cannot be ruled out that the change was initially restricted to strongly velarised contexts, but has now been generalised to all /el/ contexts by speakers who are taking part in the change. A more extensive analysis of a greater number of speakers and a comparison with historical data from the early days of the sound change may therefore yield interesting results. However, the preliminary results obtained here suggest that degree of velarisation is not directly linked to degree of /e/ lowering.
It should be noted that there were several limitations to this study. Firstly, the speech of only a small number of speakers was examined. Furthermore, only a limited number of lexical items that provided the required environment were available in the corpus, and these items did not provide a selection of very low frequency words containing the
necessary phonetic environment. So while this analysis suggests the change to be regular, a larger set of low frequency words would also need to be examined to demonstrate definitively that the change is not a case of lexical diffusion. Additionally, due to the small number of speakers and tokens and the overall nature of the project, only minimal statistical analyses were carried out on the results. Therefore, it is possible that some small but yet statistically significant correlations may have been overlooked. Consequently, future studies should attempt to incorporate a larger number of speakers, analyse a greater number of words of differing frequencies, and apply a range of statistical analyses to provide a clearer picture of this sound change.

**Conclusion**

This study has examined the /el/ - /æl/ sound change taking place in AusE. While there was an interaction between a preceding /m/ and a reduction of lowering for some of the speakers examined, no lexical effects were observable in this study and the results suggest that the sound change occurs in all lexical items that provide the required phonetic environment. Furthermore, this study found no strong correlation between degree of lateral velarisation and increased /e/ lowering. While a slight overall tendency for more lowering before less velarised laterals was observable, this effect was not significant for any of the speakers. Further examination is required to build on these results; specifically, it remains to be seen whether the change occurs in very low frequency or non-words. However, the preliminary results presented here tentatively suggest that the /el/ - /æl/ sound change in Victorian speakers is an example of a neogrammarian sound change.
References


Appendix I

List of words according to context

Following non-lateral coronal consonant
had, head, bat, bet

/æl/ context
Alan, Al

/el/ context
Mel, Elle, hell

/el/ preconsonantal context
Melbourne, elbow

Intervocalic /l/ context
Ellen, melancholy, mellow