INITIATION, PROGRESSION, AND CONDITIONING OF THE SHORT-FRONT VOWEL SHIFT IN AUSTRALIA

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ABSTRACT

This paper investigates the initiation, progression, and conditioning of the short-front vowel shift in Australian English as observed in a sociolinguistic corpus capturing 40 years in real time (from the 1970s to today). Acoustic analyses of over 10,000 tokens reveal that the lowering and retraction of KIT, DRESS and TRAP was preceded by movement in BATH. This suggests that the short-front vowel shift was structurally triggered by BATH moving away from a canonical low position and providing room for TRAP retraction, mirroring the triggering event for similar shifts in other English dialects. We also find that while pre-obstruent TRAP lowers over time, pre-nasal TRAP maintains a high position, resulting in a split-nasal system. Additionally, variance in vowel categories appears to decrease as changes crystalise, suggesting that greater within-category variability is a precursor to vocalic movement. These findings bear on the short-front vowel shift as a worldwide phenomenon in English.

Keywords: phonetics, short-front vowels, sound change, phonological conditioning

1. INTRODUCTION

Australian English has seen lowering and retraction of the short-front vowels KIT (e.g., *think, bit, big*, the most frequent words in the data with this vowel), DRESS (e.g., *get*, *never*, *remember*) and TRAP (e.g., *back*, *bad*, *family*). This is a relatively recent phenomenon, the catalyst of which has been understood to have been motion of pre-obstruent TRAP between the late 1960s and the 1990s [5, 8]. This allowed space for DRESS and KIT to lower along the front diagonal and reversed the raising that had characterised these vowels in Australia through the 20th century [8]. Additionally, TRAP today exhibits a variably split-nasal system, where pre-nasal tokens are realised as higher and fronter in the vowel space than pre-obstruent tokens [6]. Taken together, these changes have yielded a short-front vowel system in Australia that resembles many Englishes worldwide [2, 26, 28], particularly in North America [e.g., 4, 15].

Several questions remain regarding how the shift was initiated in Australia. First, in North American varieties, motion in TRAP tends to be preceded by the loss of contrast in the low back space (usually through the LOT-THOUGHT merger) [18], or the motion of a low-back vowel away from a canonically low position (usually, motion of LOT towards THOUGHT) [14]. No such loss of contrast is attested in Australian English, largely because these vowels occupy different structural positions from the described varieties in North America. Parallel to the described varieties, however, TRAP today is the lowest vowel in the system [8]. The extreme low position of TRAP in Australian English would imply some degree of category overlap with the low vowel BATH (e.g., *last*, *class*, *half*), raising the question of whether this vowel has also been affected by short-front vowel rotation. Yet the role of BATH in the context of the short-front vowel rotation has not been discussed to date.

Second, while Cox and Palethorpe [8] were the first to provide concrete evidence of the shift, they acknowledge limitations to their study. In particular, the data used to describe the shift were taken from speakers from disparate geographical regions, and many of the comparisons across time were only possible across either men or women, leading to unbalanced samples. As a result, the specific timing of the shift is difficult to pin down.

Third, it is unclear precisely when pre-obstruent and pre-nasal TRAP split. While [6] show that young speakers today exhibit variable overlap between pre-nasal and pre-obstruent TRAP, whether this split was extant in older speakers is unknown. Another issue to consider is that of self-monitoring. Raised TRAP has been the subject of comment since before the 1900s [6, 7, 23], and thus it is possible that raised TRAP might be avoided by some speakers in controlled contexts that are conducive to greater monitoring. It is, however, precisely in controlled contexts that research on TRAP has been conducted. Furthermore, variability reported in [6, 9] suggests that a sample of speech in more natural contexts might help disentangle some of the questions concerning the course of change in TRAP, and the impact of phonological environment.

The current paper seeks to fill these gaps. Drawing on a socially-stratified corpus of spontaneous speech, we explore the short-front vowel shift in apparent and real time, from the 1970s to today.

2. METHODS

2.1. Speech corpus and participants

Participants are drawn from a corpus of sociolinguistic interviews conducted with younger and older speakers over two time periods, as part of the Sydney Speaks project [27]. The first group of interviews are from the Sydney Social Dialect Survey [13], recorded in the late 1970s with adults and teenagers (born 1930s and 1960s, respectively). The second group of interviews are original recordings made by the Sydney Speaks Project in the 2010s with older and younger adults (born 1960s and 1990s, respectively). Participants (n=48) are upper working- and middle-class Anglo Sydneysiders, whose parents and grandparents are known to have spent their lives in Australia. Table 1 presents a breakdown of the participants by gender and age, from the oldest to youngest age groups represented here.

Table 1: Demographic breakdown of participants.

	1970s		2010s	
	Adults (39-64)	Teens (13-16)	Older Adults (48-57)	Younger adults (19-30)
Male	6	8	5	6
Female	5	7	5	6

The sociolinguistic interviews analysed here capture over 27 hours, or 200,000 words, of spontaneous speech, which is recognised as "the most systematic data for linguistic analysis" [17]. Spontaneous speech is particularly illuminating for the study of change, because the prestige of the standard variety is operative in more controlled settings [25], and because it motivates within-vowel variability [12]. A corpus of spontaneous speech also allows for the identification of favouring and disfavouring phonological environments pertinent to changes in progress [16]. Further, as many studies which address the short-front vowel shift in other English varieties employ data from sociolinguistic interviews, these data offer an effective means of comparison across varieties.

2.2. Data preparation, token extraction, and analysis

Speech was transcribed orthographically in ELAN [20] and force-aligned at the segment level in LaBB-CAT [10]. This process yielded textgrids in Praat [3] which were manually checked to ensure accuracy of alignment. Grammatical words and unstressed words were excluded from analysis, and no more than five instances of any one lexical item were taken from any speaker. For each vowel extracted, F1 and F2 measurements were taken at the vowel midpoint, and then Lobanov normalised on the basis of the entire vowel space [21]. This process yielded a total of 10,471 tokens across the four vowel categories of interest: KIT (n=3,840), DRESS (n=3,263), TRAP (n=2,653), and BATH (n=715).

The data were examined visually, and observed patterns were probed with linear mixed-effects regression models. In the models fit to KIT, DRESS and TRAP, F1 and F2 were combined into a single dependent variable—a measure along the front diagonal (F2-2*F1) [following 19]. For BATH, models were fit separately to F2 and F1. In testing for significance and model fit, each model included age, gender, following consonant (nasal vs. obstruent), and vowel duration as predictors, testing for logical two- and three-way interactions, with random intercepts for speaker and word. The significance of each factor was assessed using the Kenward-Roger approximation from *pbkrtest* [11] and *lme4* [1] in R [24], following recommendations in [22]. Homogeneity of variance across vowel clusters was assessed with Levene's tests, run separately on normalised F1 and F2 for each relevant data subgroup.

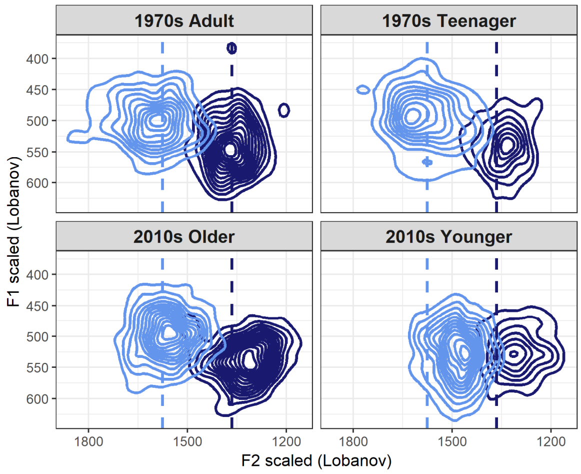
3. RESULTS

3.1. Structural initiation and progression of the shift

Results corroborate findings from [8] that there has been significant change over time in the pre-obstruent Australian short-front vowel system. KIT shows significant raising in the 1970s (from the adults to the teens, β=51.24, df=43, p=0.04), and the 2010s older adults continue this trend, though the raising no longer reaches significance (β=48.38, df=43, p=0.07). Both DRESS and TRAP show significant lowering down the front diagonal over time; however, this only reaches significance for the 2010s younger adults (as compared with the 1970s older adults; for TRAP, β=-178.92, df=43, p<0.001; for DRESS, β=-138.89, df=44, p<0.001). Importantly, we observe that movement in TRAP was preceded in time by movement in BATH, as BATH shows significant retraction in both older (β=-43.54, df=43, p=0.004) and younger 2010s adults (β=-76.26, df=47, p<0.001), with the direction of change forecast by the 1970s teens (albeit not to a significant degree, β=-20.77, df=45, p=0.12).

Figure 1 shows movement in BATH and TRAP from the 1970s adults to the 2010s younger adults, with the dashed lines representing median F2 values of 1970s adults for each vowel as reference. It can be seen that BATH begins to retract prior to obvious motion in TRAP. The distribution of BATH shows signs of retraction in 1970s teens, when TRAP has not yet begun to retract. In 2010s older adults, BATH retraction continues, and TRAP begins to shift to a slightly more retracted position relative to the 1970s groups. In 2010s younger adults, both vowels have moved to a more retracted position, and it is at this point that TRAP is significantly more retracted than it was for 1970s adults. That BATH retraction precedes TRAP retraction is indicative of a structural connection between the two phenomena, namely, that retraction of BATH provided space for TRAP to retract.

Figure 1: Two-dimensional kernel density plots of pre-obstruent TRAP (light) and BATH (dark) in normalised and scaled F1/F2 space; dashed lines are median F2 values of 1970s adults.

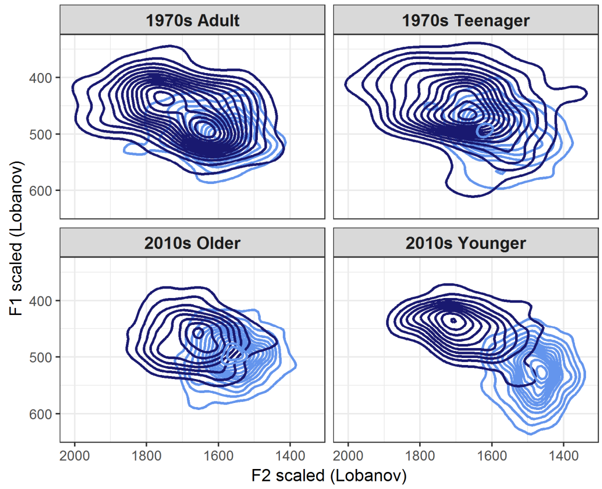


3.2. Effect of following nasal over time

We also observe significant change in pre-nasal TRAP over time, as can be seen in Figure 2. While pre-nasal TRAP on aggregate has always occupied a relatively higher position than pre-obstruent TRAP, the difference between the two has grown considerably over time, attributable to both retraction in pre-obstruent position and raising in pre-nasal position. To examine this, we treat pre-obstruent TRAP in 1970s adults as a benchmark. While pre-nasal TRAP is significantly higher and fronter than pre-obstruent TRAP in 1970s adults (β=126.39, *df*=2333, p<0.001), there is considerable overlap between the two phonological environments for both 1970s adults and teenagers. Overlap decreases for 2010s older adults (β=43.09, *df*=2602, p=0.04) and for the younger adults, the difference between pre-obstruent and pre-nasal TRAP has grown such that there is little overlap (β=206.57, *df*=2597, p<0.001).

The raising of pre-nasal TRAP yields a system in which pre-nasal TRAP and pre-nasal DRESS occupy similar places in the vowel space. Nevertheless, these two vowels show a difference in duration [cf. 7], and this difference is stable over time (with log normalised pre-nasal TRAP consistently about 1.4 times as long as pre-nasal DRESS across age groups).

Figure 2: Two-dimensional kernel density plots of pre-nasal (dark) and pre-obstruent (light) TRAP in normalised and scaled F1/F2 space.

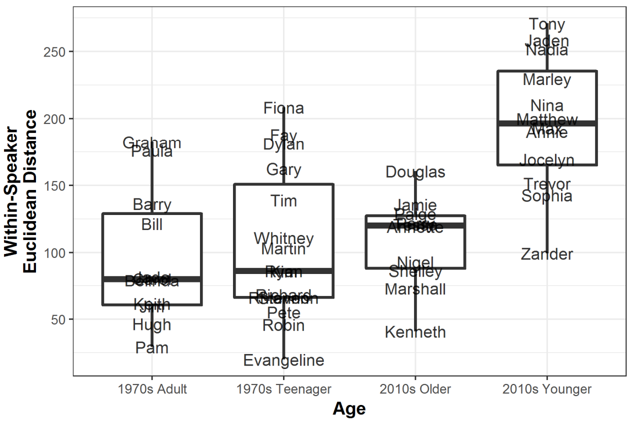


Alongside the changes in TRAP, there is an apparent diminishing of variance, as seen in the tighter density plots in Figure 2. This reaches significance for pre-nasal TRAP; Levene's tests indicate unequal variances between the 1970s and 2010s speakers in F1 (F=15.10, p<0.001) and F2 (F=27.50, p<0.001). We interpret the diminished variance as an indication that this change may be stabilising.

We now turn to consider the social context for changes in TRAP. First, women appear to have led this change. In comparison to older 1970s women, 2010s older (β=-76.66, *df*=2593, p=0.007) and younger adult men (β=-71.58, *df*=2585, p=0.01) exhibit less extreme differences between pre-obstruent and pre-nasal TRAP.

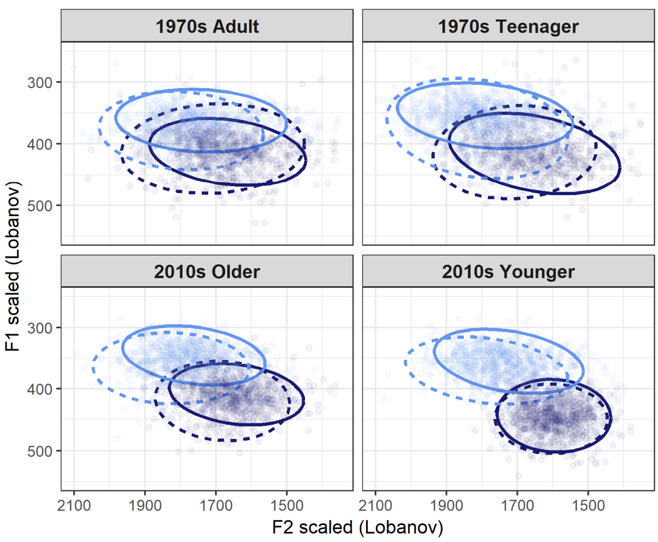
Within-speaker patterns are presented in Figure 3. Here we see that several 1970s speakers produce little difference between pre-nasal and pre-obstruent TRAP, indicated by their relatively small Euclidean Distances. Some speakers in the 1970s (for example, Pam, Hugh, Robin and Evangeline) exhibit differences of less than 50 Hz between pre-nasal and pre-obstruent TRAP. Only one speaker from the older 2010s group (Kenneth) shows such a small distance, and none of the younger speakers do. Overall, the median and distribution of Euclidean Distances increase over time, ultimately resulting in two distinct distributions in the 2010s younger adults, with Euclidean Distances at or above 100 Hz. This is indicative of a complete allophonic split that has yielded two allophonically conditioned categories for the speakers examined here—pre-obstruent TRAP and pre-nasal BAN.

Figure 3: Within-speaker Euclidean Distances between pre-nasal and pre-obstruent TRAP.



What of DRESS and KIT? Phonological context plays a comparably low-level phonetic role in the realisations of these two vowels (see Figure 4). First, the raising of KIT is restricted to pre-obstruent position, while pre-nasal KIT is relatively stable over time. Second, for DRESS, the impact is seen in the degree of variance exhibited over time. The variance in pre-nasal and pre-obstruent contexts decreases from 1970s adults to 2010s younger adults (Levene's test (F2), F=110.19, p<0.001), but pre-nasal DRESS also has greater variance in F1 than pre-obstruent DRESS for all age groups, up to 2010s younger speakers, who show not only equal means and distributions in both phonological contexts, but also equal variance. Pre-nasal DRESS would seem to have had a more variable target, which has narrowed over time. We hypothesise that this diminishing of variance is associated with stabilisation over time.

Figure 4: Tokens and ellipses (95% CI) of DRESS (dark) and KIT (light) for pre-obstruent (solid line) and pre-nasal (dotted line) environments in normalised and scaled F1/F2 space.



4. DISCUSSION AND CONCLUSIONS

The data reported here enhance our understanding of the way in which the short-front vowel shift has progressed in Australian English. While the overall findings corroborate the general lowering and retraction observed in the vowels TRAP and DRESS in [8], we also observe that the retraction of TRAP was predated by retraction of BATH. The temporal proximity and sequencing of these events demonstrated here provides evidence that the retraction of BATH and the lowering of the short-front vowels along the front diagonal are related. Reviewing similar changes in North American varieties suggests that motion in the low-back space may be highly structurally linked to the rotation of the short-front vowels in general. That this shift is not triggered by the complete loss of contrast in the low-back space is in line with recent work, which has argued that motion of a low-back vowel away from its canonical position may be enough to trigger TRAP retraction [14]. Indeed, it appears that in Australia, the movement of BATH to a more retracted position may have been a sufficient initiating force.

This study also addresses the way that pre-nasal TRAP has proceeded alongside the short-front vowel rotation. The data presented here provide evidence that this has been a gradual process; pre-nasal TRAP has always been in a higher, fronter position relative to pre-obstruent TRAP, but it has shifted to a slightly higher position over time, while simultaneously becoming less variable. On a speaker-by-speaker basis, we observe here distinct targets for TRAP and BAN, in contrast to findings from other studies of young women in Sydney [6]. One possible explanation for this difference is the data type used; as the raising of pre-nasal TRAP is socially marked, speakers may tend to avoid doing so in more controlled environments, thus resulting in more overlapped systems. Finally, for DRESS, the impact of phonological conditioning is primarily relegated to the changing degrees of variance.

Through apparent and real-time comparisons of the spontaneous speech of older and younger speakers in the 1970s and today, we have been able to shed new light on the rotation of the short-front vowels in Australian English. Specifically, we propose that the initiating event was the retraction of BATH; we demonstrate the way in which pre-nasal position has impacted the short-front vowels over time; and we propose that degree of variance may prove to be a valuable indirect measure of the progression of a change.

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