The urge to unmerge: a case of structural change across the lifespan

Marc Barnard, Robert James Hellyer & Sophie Holmes-Elliott

Queen Mary University of London
m.e.barnard@qmul.ac.uk, r.j.hellyer@qmul.ac.uk, s.holmes-elliott@qmul.ac.uk

ABSTRACT

This paper considers change across the lifespan by investigating an adult speaker's development from a one-part low back vowel system to a two-part system. Specifically, we use podcast data to track the real-time development of a LOT-THOUGHT split in the speech of an American English speaker who previously exhibited a merged system in production. Using automatic forced alignment, we extracted measures of the first and second formants. Degree of overlap was analysed using lmers and Pillai scores. Analysis revealed that the speaker's one-part system diverged into two statistically significantly distinct categories, coming to resemble the dominant pattern of the region in which he resides. As previous work indicates that grammatical plasticity is constrained in adulthood, the current finding contributes a new insight into the nature of post-critical period change. These findings are discussed within the broader context of underlying phonological representations and motivations behind language change across the adult lifespan.

Keywords: lifespan change, sociophonetics, low back vowels, merger, plasticity

1. INTRODUCTION

1.1. Change across the lifespan

Research into language change across the lifespan has presented evidence that adult language systems tend to be relatively stable [24]. Relatedly, some aspects of grammatical plasticity appear to be significantly constrained after the end of the critical period [24], hypothesised to occur in late adolescence [29]. Despite this, a growing body of work shows that lifespan change is possible to some degree [7, 9, 12, 14, 15, 20, 21, 24–26, 28]. The full extent to which post-adolescent acquisition is limited to certain types of language change is uncertain [12]. It is still unclear if adult language change involving structural phonological categories is possible, or whether it is restricted to more superficial adjustments [24].

The current paper contributes to this area by presenting a case study focussed on production data from one adult speaker whose speech evidences the development of a phonemic split where one vowel category becomes two.

1.2. The limits of change across the lifespan

Previous findings regarding the existence and nature of limits to post-adolescent language change are inconclusive. However, evidence of complex structural change is rarely, if ever, attested.

The most commonly reported type of lifespan change is that which occurs among already-variable elements of the grammar. Adult speakers may alter their rate of one variable linguistic feature due to sociolinguistic pressures, while maintaining the other variant [25]. For example, Sankoff & Blondeau [26] found that Montreal French speakers who already varied between dorsal and apical /r/, shifted their preference towards the dorsal variant in line with a community-wide change in progress. Likewise, in her analysis of Sir David Attenborough's speech, MacKenzie [12] finds that he removes a previous existing constraint on variable tapped /r/ use. Attenborough initially uses a greater rate of /r/-tapping in intervocalic, word-internal positions (e.g., *forest*) and fewer in situations where /r/ links two words (e.g., *for a*). However, he begins to show similar tapping rates in both contexts, due to the reanalysis of certain frequently-uttered collocations as single words. In this way, MacKenzie [12] argues that while his surface pronunciation shifts, the grammatical rules governing his use of this variable remain fixed.

Further, evidence shows that it is easier for adults to simplify their phonological system by merging categories than complexifying it through adding a new phoneme or allophonic rule [2]. In her study of Noam Chomsky, Kwon [9] uses historical recordings to track his vowel system across time. She finds that he approximates the local merged low back vowel system after moving to Boston, having previously produced separate LOT and THOUGHT categories. However, the merger does not reach categoricity, suggesting that the underlying phonemes may remain distinct and no phonological restructuring takes place. Similarly, Riverin-Coutlée & Harrington [21] show how speakers may adopt merged categories that can be used stylistically alongside their initial system. Michaëlle Jean, a Quebec French public speaker, appears to lose a typically Quebecois allophonic distinction between tense and lax vowels when

regularly addressing an international audience, though reverts to her earlier split system when these pressures relax. That adult acquisition of simple changes such as mergers may be easily reversible [20, 21, 27] may indicate a lack of underlying grammatical change. Instead, speakers may be altering the surface realisation of their speech for stylistic purposes.

More complex patterns such as splits are relatively rare in the literature [4, 9, 14] and where speakers do acquire these, they often do not achieve native-like categoricity [26]. For example, Kwon [9] finds that Chomsky begins to reorganise his short-a system towards the more complex nasal system, but he fails to completely master the allophonic split. Likewise, Evans & Iverson [7] find that northern English speakers begin to change their STRUT and FOOT realisations towards southern-like vowels, but this is not accompanied by changes in perceptual processing. This may indicate that while phonetic realisations are available for change, adult speakers' phonological representations remain constant. In both of these cases, speakers who change do not achieve a native-like split between the two categories.

1.3. An example of complex change?

Taken together, the above findings suggest that adult language change appears to be largely limited to more simple changes. Acquiring new structural categories, such as phonemes, appears to be a much harder task. This supports Chambers' [2] third principle of second-dialect acquisition, whereby simpler phonological rules are easier to acquire than complex ones.

The current research presents preliminary evidence that complex structural change, in this case the adoption of a split low back vowel system, may be possible among adult speakers. The implications of this for our understanding of lifespan change are also discussed.

2. METHODOLOGY

2.1. Sample

This study exploits readily available data in the form of a podcast, *Overdue*. The book-discussion podcast is recorded remotely by two native US-English speakers, Andrew Cunningham and Craig Getting. Andrew was brought up in Central Ohio, an area with a merged LOT-THOUGHT category [10]. At the time of recording, he was living in New Jersey, where these categories tend to be split [10]. Craig was also living in a split area, Philadelphia, where he was born and grew up. The study examines speaker accommodation to the ambient dialectal pattern in their respective communities. If this occurred, we would predict that Craig's system would remain stable, whereas Andrew's one-part system would shift towards a two-part, in line with the ambient Philadelphian dialect.

2.2. Data processing

Data were drawn from four episodes spanning roughly three years (Ep. 22, July 2013; Ep. 65, Jun 2014; Ep. 119, Jun 2015; Ep 183, Jun 2016). Episodes were accessed on Spotify, recorded using Audacity and orthographically transcribed using Transcriber. The data were forced aligned using DARLA [19]. F1 and F2 values were extracted at one-third of the way between onset and offset, following Labov, Rosenfelder & Fruehwald [11], and Lobanov normalised. The output was manually checked by the researchers, with unstressed and non-native words removed. A total of 825 tokens of LOT and THOUGHT were analysed, from 159 minutes of podcast recordings (see Table 1 below).

Table 1: Table showing the minutes of recorded data and the number of tokens analysed.

Time point	Minutes	LOT tokens	THOUGHT tokens
July 2013	35	*Andrew*, 19 *Craig*, 95	*Andrew*, 17 *Craig*, 55
June 2014	35	*Andrew*, 26 *Craig*, 31	*Andrew*, 14 *Craig*, 19
June 2015	56	*Andrew*, 42 *Craig*, 164	*Andrew*, 30 *Craig*, 56
June 2016	33	*Andrew*, 87 *Craig*, 93	*Andrew*, 34 *Craig*, 42

2.3. Analysis

Acoustic analysis was performed in three stages. First, the Lobanov normalised F1 and F2 of each token was plotted (see Figure 1 below). Following this, the overlap of the distributions was quantified using Pillai scores. Pillai scores are the output of a MANOVA and consist of a score between 0-1 showing degree of overlap, with 0 representing no distinction between the categories and 1 showing no overlap [16]. Following this, data were analysed using Linear Mixed Effects Regression (lmer) modelling in R [18], to statistically confirm any significant differences in Lobanov normalised F2 values over the time points. Fixed effects included a three-way interaction of Speaker, Vowel and Time, as well as Following Segment. Word was included as a random intercept.

3. RESULTS

Analysis of Andrew's LOT/THOUGHT categories suggest that over the course of the three years his initially merged system comes to approximate Craig's split system.
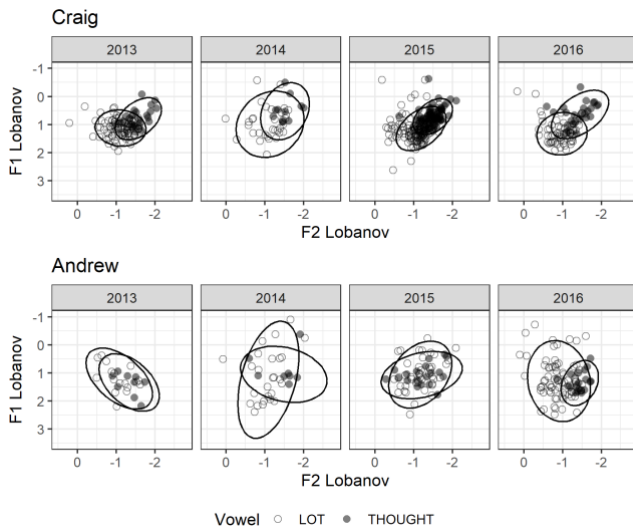

Figure 1: Distribution plots showing Lobanov-normalised F1 and F2 values for Craig and Andrew.

Figure 1 shows the Lobanov-normalised F1 and F2 distributions of LOT and THOUGHT categories for both speakers. Each point represents a single token, LOT in outlined points, THOUGHT in solid, with ellipses generated to represent the spread of each speakers' vowel distribution and relative overlap. Craig's results serve as an example of a typical split system, as used by a speaker with a similar demographic profile to Andrew. His token distributions suggest that he has two low back vowel categories, as the distribution ellipses coalesce around two separate centre points, indicating different mean F1 and F2 values for both categories. The ellipses remain distinct throughout all time points, suggesting that Craig's vowel system shows little change over time.

In contrast, Andrew's vowels do not show substantially separate distributions until 2016. From 2013 to 2015, the distribution of his LOT and THOUGHT categories closely resemble each other, with high degrees of overlap. By 2016, the means and distributions of the two vowels have begun to separate into two distinct categories. During this episode, Andrew's vowel system appears to resemble Craig's patterning, with a fronter LOT vowel and a backer THOUGHT category.

Table 2: Table showing Pillai scores and p-values from the three-way interaction in the lmer model (Speaker*Vowel*Time), with vowel F2 as the dependent variable.

| Year | Craig | | Andrew | |
	Pillai Score	lmer 'vowel' *p*-value	Pillai Score	lmer 'vowel' *p*-value
2013	0.401	<.0001	0.146	0.56
2014	0.296	<.0001	0.128	0.32
2015	0.251	<.0001	0.005	0.78
2016	0.491	<.0001	0.278	<.0001

The Pillai scores in Table 2 further support this analysis. From 2013-2015, Craig's scores are consistently higher than Andrew's, indicating a greater distinction between the two categories. By 2016, Andrew's Pillai score is within the range of Craig's scores, suggesting the distribution of the two categories has become more distinct.

The lmer model indicates that the observed pattern reaches statistical significance. The difference in F2 between Craig's LOT and THOUGHT categories remains significant at every time point (at p<0.0001; see Table 2). However, Andrew's categories are not significantly distinct until 2016.

4. DISCUSSION

4.1. General discussion

The current findings show that Andrew's previously merged low back vowel system splits into two separate categories, a fronter LOT and backer THOUGHT. In this way, he begins to approximate a speaker with a native unmerged system. This result is surprising in light of previous work that has emphasised the difficulty with which adult speakers acquire complex phonological patterns, such as splits. The development of such a pattern may indicate that the post-adolescent language faculty is more malleable than previously hypothesised. Further, the fact that Andrew's split resembles Craig's native two-part system stands in contrast to previous examples of complex change [7, 9], where the patterns acquired are not native-like. This may provide further indication that adult speakers are better at acquiring new and complex language features than earlier work suggests.

While any complex production shift is unexpected, it is difficult to ascertain from the current data whether this reflects changes to Andrew's underlying representations. Labov, Ash & Boberg

[10] show that for many Central Ohioan speakers, the merger is in a transitional stage, or present in perception but not production. Likewise, Durian [6] argues that while many speakers' realisations of the two phonemes are very close, not all speakers in Central Ohio have a complete merger. It may be the case that Andrew's original phonological system contained two low back vowel categories, but that he realised these categories identically, in line with the increasingly dominant pattern in that part of the Midwest [6]. Andrew could be reverting to an earlier pattern that he had already stored, rather than learning a new system. His case is perhaps similar to that of Michaëlle Jean, who exhibited a simpler system in adulthood, but retained her more complex native system for stylistic use [21]. However, from the available production data, these interpretations are necessarily speculative. Psycholinguistic methods would be required to more fully understand the status of Andrew's underlying grammar.

4.2. Mechanisms for lifespan change

The mechanisms by which Andrew's language shifts are also unclear. One relevant factor in adult language acquisition is degree of exposure to new features [23, 28]. Andrew is surrounded by the two-category system in his adopted home state of New Jersey, and it is common for speakers who have moved region to acquire new dialect features through ambient exposure [14, 23, 28]. Regular interaction with his unmerged co-host may also reinforce use of the split system. Interspeaker phonetic convergence has been shown to occur within individual conversations [1, 8], as well as longitudinally [17]. Recent scholarship has emphasised that relatively automatic acquisition from the surrounding environment and socially-determined convergence to individual speakers may play complementary roles in processes of phonetic change [1, 3, 22]. For example, Ross et al. [22] find that familiarity from exposure to a second dialect facilitates phonetic convergence in dialogic situations. Similarly, Andrew's shift towards the split system may be driven by both immersion in the unmerged dialect of New Jersey, and a desire to accommodate towards Craig's speech. The fact that both speakers currently live in states with a split low back vowel system could indicate why it is Andrew, rather than Craig, whose speech changes.

4.3. Motivations for lifespan change

This account, however, still fails to explain why Andrew split his categories at that particular moment. By 2016, Andrew had been living in New Jersey for five years, and co-hosting the podcast with Craig for three. One possibility is that these five years represent a threshold at which he had acquired enough input to produce the unmerged system. However, this hypothesis finds little support in previous work, where length of residence in a second dialect region has shown to be an insufficient predictor of adult language change [28]. Other social motivations must be at play. One possible factor is his upcoming move to Philadelphia, another split region and the hometown of his co-host. This occurs around a month after the 2016 episode analysed here and is extensively discussed in one of the following episodes (Ep. 186). Orientations towards place have been shown to correlate with adoption of new dialect features [13, 15], and may influence production before any actual move takes place [5, 13]. For example, De Decker [5] finds that Ontarians who wish to move to the city show distinct vowel patterns compared to those who intend to remain in a rural area. This suggests that the timing of Andrew's vowel shift could have been determined by his anticipation of the upcoming move, which increased the salience of Philadelphia and his degree of orientation towards the city. While Andrew may have acquired the split categories through ambient exposure, sociolinguistic factors such as place orientation and communication accommodation may have determined why the split system appears in his own speech in 2016.

5. CONCLUSION

The current research provides evidence of an adult speaker who begins to produce split LOT and THOUGHT categories after previously exhibiting a merged low back vowel system. This finding runs counter to previous claims that adult speakers are unable to reliably acquire new complex patterns. Accordingly, the podcast hosts offer a valuable case study that contributes to our understanding of the types of language change that are possible following the critical period. The present research is limited to a focus on production; the question of whether the change constitutes phonological restructuring would require a longitudinal study of perception. Further perceptual work would also elucidate the extent to which Andrew's vowels perceptually resemble Craig's for Philadelphians. The mechanisms and motivations behind Andrew's shift also remain unclear, but a combination of ambient exposure, sustained interaction with Craig, and a stronger orientation towards a dialectal region which exhibits the split are all likely contributing factors.

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