Merging Phonemes in Real Time

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Introduction.

Ever since Labov's classic study on Martha's Vineyard Island (Labov 1963), it has been the norm in sociolinguistics to use apparent time as a means of studying language change in time. However, Chambers and Trudgill point out that the link between apparent time and real time may be more complex than initially believed (1998:151). Indeed, research on change within the lifetime shows that language can and does change long after reaching adulthood (Harrington, Palethorpe & Watson 2000).

Research on language in real time has revealed several patterns. Bowie reports that speakers' frequency of (wh) aspiration were relatively stable throughout adulthood, though many had at least some period of significant deviance (Bowie 2015). Harrington, Palethorpe, & Watson showed that the Queen of England's vowels shifted not in a random and haphazard way, but in the direction of the ongoing changes Southern British English (Harrington, Palethorpe & Watson 2000). Finally, a mixture of the two is reported in Reubold & Harrington (2015) wherein they report that, after spending some time in the United States, a British speaker adopted some features of General American English but then reverts back to British English Received Pronunciation later in life.

While the phonetic realizations of these features change over time, the phonological inventory and classification of sounds remains the same. In other words, the speakers in Bowie (2015) have aspirated (wh) throughout their lives (albeit with varying frequencies), the Queen of England has the same number of vowels as she did when she was younger, and the changing features in Harrington & Reubold (2015) were phonetic in nature. In this paper I will present evidence for phonological change within the individual, focusing on the cord-card merger and the horse-hoarse merger in Utah English.

Labov, Ash, and Boberg describe the cord-card merger and the hoarse-horse merger as

mutually exclusive mergers that are the result of what was historically a three-way distinction of /or/, /ɔr/, and /ar/ collapsing down to two. In most of North American English, the /ɔr/ words merged upwards with /or/ to form the horse-hoarse merger while in parts of New England, the South, St. Louis, and Utah this class moved down to merge with /ar/, resulting in the cord-card merger (2006:49–53). In northern Utah, the cord-card merger became common in the late 19th century (Bowie 2003) and was complete in the 1930s (Helquist 1970), but then was quickly supplanted by the horse-hoarse merger in later decades (Lillie 1998). Today the cord-card merger has been essentially abandoned in favor of the horse-hoarse merger (Bowie 2010), though some relics remain, such as the common lower pronunciation of the name *Laura* as [lɑra] in Utah (Chatterton 2008).

Methodology.

Data for this project comes from religious sermons given by the late Tom Perry, a notable leader in the Church of Jesus Christ of Latter-day Saints. Perry was born in 1922 in northern Utah, so it is expected that the cord-card merger be present in his speech. From 1974 until his passing in 2015, he gave 84 sermons at religious conferences, which are publically available for download as high-quality recordings at www.lds.org[1]. For this project, only 20 sermons given in 1973–1974, 1983–1984, 1993–1994, 2003–2004, and 2013–2014 were used, totaling just short of 5 hours of speech.

After being transcribed by hand, the recordings were processed using FAVE-Extract (Rosenfelder et al. 2014) to extract vowel formants, which incorporates Prosodylab-Aligner (Gorman, Howell & Wagner 2011) for automated alignment. Potential cord-cord words, which were defined as those with pre-rhotic /o/ or /a/ in stressed position, were extracted (n=1,311) and formant values from the midpoint of the vowel were used for analysis.

Each of these lexical items were then classified as either /or/, /ɔr/, or /ar/ based on their historic three-way pronunciations (Walker 1807) in order to predict their phonetic realization. For speakers with a complete cord-card merger such as those in Salt Lake City in the 1930s, the

[1] This is not the first time the cord-card merger was studied using Perry's speech as a data source: The native of northern Utah born in 1922 mentioned in Bowie (2008:37) is undoubtedly Tom Perry, whose "religiously themed television broadcasts" are likely from this same corpus.

/ɔr/ and /ar/ classes of words are presumed to both be pronounced as [ar]. Meanwhile, it is more common for words that are classified as /ɔr/ and /or/ to be realized phonetically as [ɔr] in speakers with a horse-hoarse merger.

Formant values extracted from these recordings were then analyzed using MANOVA (multivariate analysis of variance) tests, which are appropriate for data with multiple continuous response variables as predicted by one or more explanatory variables. In this case, F1, F2, and F3 values are being predicted by class membership (the historic pronunciations of /or/, /ɔr/, and /ar/). The data was also visually inspected by plots produced by the `phonR` and `ggplot2` packages in `R` and the statistical software JMP version 11.0.

Results.

In order to test whether Perry spoke with a cord-card merger in the 1970s, a MANOVA test was run to see whether the /ɔr/ class was significantly different from the /ar/ class. The test showed that while the /ɔr/ class was distinct from /or/ as expected, it was also distinct from /ar/, resulting in a three-way split (Pillai's score: 0.175, df = 3, $p < 0.0001$). Meanwhile to test the presence of a horse-hoarse merger in the 2010s, the same test was run with the expected results being that the /ɔr/ class is not significantly different than /or/. Again though, the test results suggest a three-way split in the classes (Pillai's score: 0.084, df = 3, $p = 0.001$).

Turning to a visual analysis of the data, when the first two formants of each observation

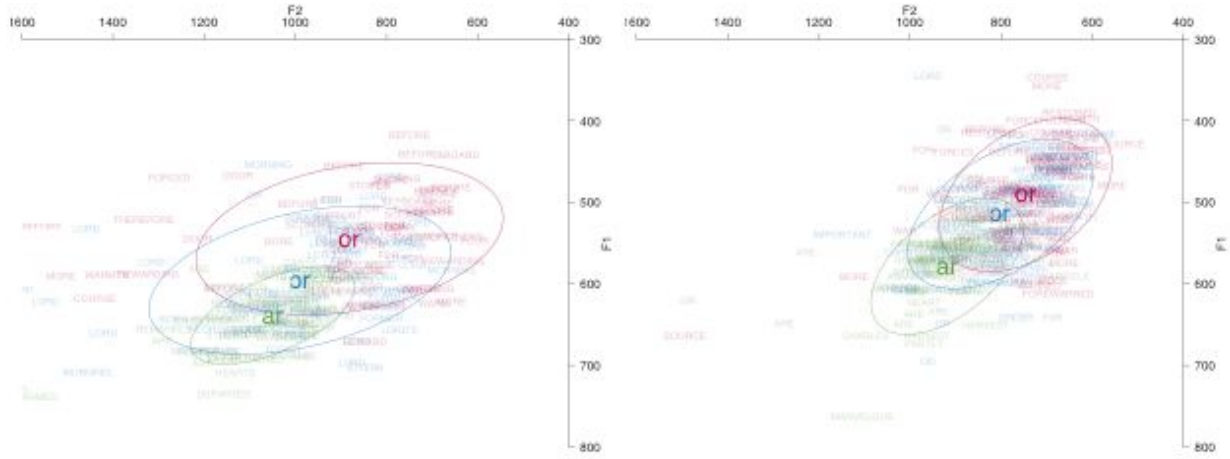

Figure 1. Two-dimensional visualizations of the vowel space in the 1970s (left) and the 2010s (right). Plotted using the `phonR` package in `R`.

are plotted in the vowel space, the distributions of the three classes can be easily seen. Figure 1 shows these distributions, with colors representing each class and ellipses covering one standard deviation from their mean. The plot on the left, which includes only data from the 1970s, shows that while all three classes overlap somewhat, the /ar/ words are almost entirely within the /ɔr/ cloud, suggesting something close to a cord-card merger. Additionally, the middle of the /ɔr/ cluster is slightly closer to /ar/ than /or/. However, given the similarities in distributions between /ɔr/ and /or/, it cannot be described as a clear cord-card merger. Meanwhile though, the plot on the right, which includes data from just the 2010s, shows that the /ɔr/ class is much closer to the /ar/ group, both in its mean and distribution, suggesting a clearer case of a horse-hoarse merger. Data from the 1980s, 1990s, and 2000s, though not plotted here, show the intermediate steps between the first and last decades, suggesting a gradual but fairly consistent change in time.

In order to visually represent all three formants, a three-dimensional vowel chart was plotted using JMP by adding F3 as a depth dimension. In Figure 2, the plot on the left again represents the data from the 1970s and the plot on the right shows data from the 2010s. In the 1970s the difference between /or/ and /ɔr/ is more apparent (though admittedly still not striking)

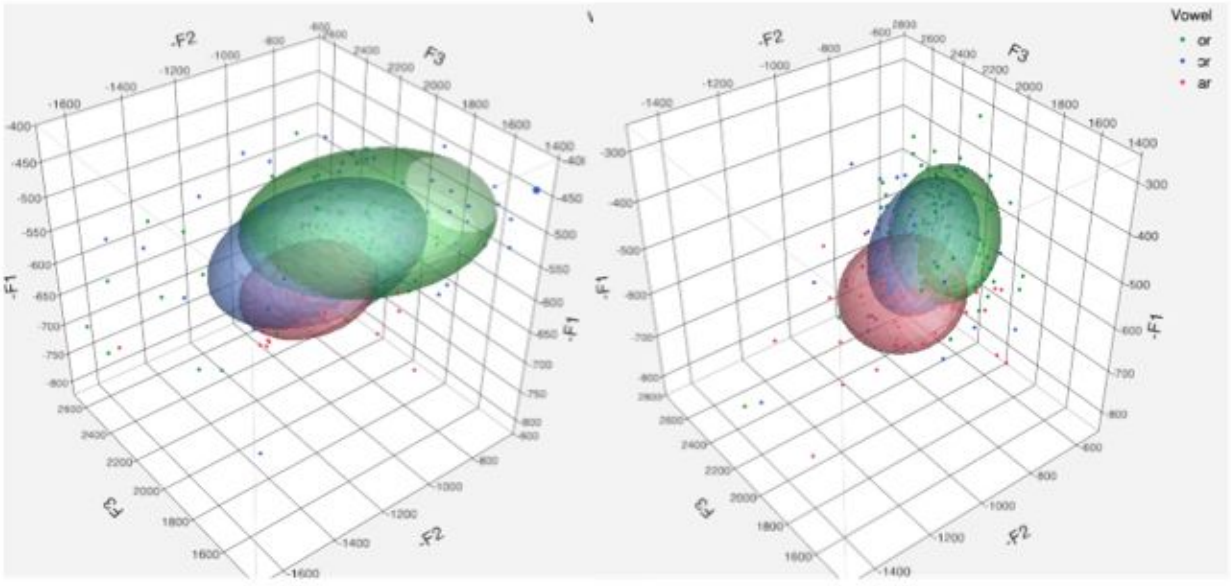

Figure 2. Three-dimensional visualizations of the vowel space in the 1970's (left) and the 2010s (right). Plotted in JMP.

but their overlap is more evident in the 2010s. The plot on the right in Figure 2 also shows data from the 2010s, in which the lower /ar/ group is more visually off-set than the other two higher classes. Again, the other decades are not plotted, but show systematic, step-by-step change as intermediate steps between the 1970s and 2010s plotted in Figure 2.

Discussion.

At first there appears to be a discrepancy between the statistical tests, which indicate a clean three-way split, and the visualizations, which suggest more merging in the later years. However, the reason for the apparent statistical significance lies in the large dataset being tested. Given enough data, even the smallest of differences between groups produces a small p-value in a MANOVA test because it finds the angle in which the classes are most distinct. We see in the scatterplots though that it may not be entirely wrong since there were major differences between all three classes.

Given that Perry was born in northern Utah around the time that the cord-card merger was reportedly widespread, it is expected that he have this feature. However, based on the data presented, it must be concluded that while he did not have a horse-hoarse merger in the 1970s, he also did not have a cord-card merger. Labov, Ash, & Boberg also found statistically significant three-way splits in their data (2006:51), but they conclude that it was not a fully phonemic distinction between /ɔr/ and /or/. Bowie (2008), which also analyzed the speech of Perry drawn from this same corpus, describes a clean three-way split when taking into account all three formants, so this is not unexpected. One explanation for this in Perry's speech is that he was already in his 50s at this time, and the earliest data for this project may be just a snapshot of an ongoing lifelong change of /ɔr/ merging from /ar/ to /or/.

Moving towards the most recent data, it is clear that he spoke with a horse-hoarse merger, the more contemporary feature. Though not shown here, graphs from the 1980s, 1990s, and 2000s show a gradual change, particularly in the /ɔr/ class. While all three vowels raised due to the vocal tract lengthening with age (Endres, Bambach & Flösser 1971; Xue & Hao 2003), it appears that the /ɔr/ class did so more than the other two. Overall, this suggests a change from an unstable three-way distinction to a somewhat clear horse-hoarse merger.

Thus it appears that Perry's speech has shifted in the general direction of the ongoing

change in his community, just as the Queen of England did as reported in Harrington *et al* (2000). Contemporary Utah English has abandoned the cord-card merger and, as Perry was surrounded by a new majority feature, over the course of many decades his realization of the /ɔr/ class of words presumably changed to match the community around him. Because he moved from the the cord-card merger or a three-way split to the horse-hoarse merger, it appears that he has lost a contrast in his phonemic inventory.

Change over the lifetime that is generally in the direction of ongoing change in the surrounding community causes problems with the apparent time hypothesis. Assuming that language does not change in a significant way during an individual's lifetime, if a researcher wanted to study northern Utah English in the 1930s and used Perry as a representative of that time, the researcher would have to conclude that the cord-card merger was not as robust and widespread as it actually was. Thus, linguistic change is in reality faster than apparent time data would lead us to believe (Labov 1994).

Conclusion.

While previous real time studies have shown that phonetic realizations of phonemes change over time, this study shows that even the phonology of a speaker is subject to change during their lifetime. In this paper I have provided evidence for such a change in one speaker, using real time data over four decades. While a more robust sample size and more empirical evidence are needed to adequately support this claim, it opens the doors for further exploration in phonological language change in real time.

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