A Social Meaning Perspective on Vowel Trajectories: The FEEL-FILL Merger among African Americans

Abstract
Studies have shown that fine-grained phonetic details play an important role in signaling linguistic contrasts (Labov et al. 1991, DiPaolo and Faber 1990). Listeners are attuned to differences in duration (Bailey 2001, Thomas 2001), phonation type (Yaeger-Dror and Thomas 2010), and monophthongization and diphthongization (Kohn 2013). That listeners are attuned to each of these cues provides evidence that many differences in sound can be used to convey phonological distinctiveness and preserve contrasts in the linguistic system. I show that distinction in the FEEL-FILL merger is maintained by vowel contours and that, furthermore, contour emerges as socially indexical. Analysis of 24 African Americans from Bakersfield and Sacramento, California shows that African American men merge FEEL and FILL such that F1 is diphthongal and overlapping throughout the rhyme for both vowel classes while African American women maintain a distinction with a relatively flatter FILL F1 contour. Additionally, younger African Americans and African Americans with higher levels of education have a relatively flatter FILL contour. Whereas a diphthongal FILL is in alignment with the Southern Vowel System, a monophthongal FILL is aligned with California English. Thus, the gendered pattern is located within a pattern of change in which women are leading a change away from the Southern pattern in part due to an emphasis on respectability and social mobility. These findings demonstrate that the vowel contour can be distinctive and carry social meaning, as well.

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A Social Meaning Perspective on Vowel Trajectories: The FEEL-FILL Merger among African Americans

Zion Mengesha*

1 Introduction

The observation of vowel mergers has been central to sociolinguists’ documentation of language variation and change, so how we identify – and misidentify – mergers has implications for the field (Nunberg 1980). Over the past several decades, sociolinguists have identified mergers from overlap at a single-point of the vowel in F1 and/or F2. However, distinctions between vowels often depend on more than vowels’ single-point placement in the vowel space. For example, listeners are attuned to differences in duration (Bailey 2001, Thomas 2001), phonation type (Yaeger-Dror and Thomas 2010), and monophthongization and diphthongization (Kohn 2013). That listeners are attuned to each of these cues provides evidence that many differences in sound can be used to convey phonological distinctiveness and preserve contrasts in the linguistic system (Labov et al. 1972). As this paper will show, the overall contour of the vowel can be distinctive, and carry social meaning as well.

Research has shown that vowel trajectories shed light on mergers. Within the same vowel category, trajectories can differ for speakers of different dialects. For example, Thomas (2001) found differences in the trajectory of /ai/ for speakers of Ohio English and Texas English, and Hinrichs et al. (2013) found social stratification in the trajectory of GOOSE among Texans. While vowel trajectories are a useful measure of movement, they are calculated from difference measures between two points in the vowel, often at 25% and 75%. The vowel contour - or how the vowel moves through that space - yields additional insight about phonological contrast that is unobservable from any steady state F1 or F2 measure(s) alone. Recent work has begun to explore (e.g., Hall-Lew et al. 2021) how the vowel contour can yield socially indexical information, but to date, no studies have shown that phonological distinction is maintained by contours. Using the /l/-controlled vowels FEEL and FILL as a case study, I show that distinction is maintained by vowel contours, and that furthermore contour emerges as socially indexical.

1.1 The Feel-Fill Merger

Labov et al. (2008) reported an isogloss spanning North Carolina, South Carolina, Georgia, Mississippi, Louisiana, and Texas for the FEEL-FILL merger, which suggests that it is a feature of Southern American English. That the FEEL-FILL merger has been documented across the southern United States makes it a resource to index a particular kind of regional identity. Again, in the Atlas of North American English, Labov et al. (2008) found that over 90% of speakers who produced the FEEL-FILL merger outside of the South, in cities such as Los Angeles, Chicago, Detroit, and New York City, were African American. These findings suggest that the FEEL-FILL merger is a feature associated with both Southern American English and African American English. Thus far, limited work has been conducted on FEEL and FILL in California, but there are some African Americans who have merged FEEL and FILL in California (Labov et al. 2008). Taken together, what these findings suggest is that African American speakers may merge FEEL and FILL in California to negotiate racialized subjectivity. This paper uncovers the social and phonological distinctions African American speakers can construct using the vowel contours of FEEL and FILL.

The data used in this study came from interviews conducted in Bakersfield and Sacramento in 2012 and 2014 through Stanford University's Voices of California dialectology project. Both field sites are in the Central Valley, which is known for its agricultural industry that produces more than half of the country's fruits, vegetables, and nuts (Hastings 2014). Additionally, both cities have a

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history of racial segregation that particularly affected older residents.

Bakersfield is in Kern County approximately 100 miles north of Los Angeles with a population of over 407,000 (US Census Bureau 2021). Its primary industries are agriculture and oil production. Currently, white residents make up an estimated 61% of the Bakersfield population and African Americans make up 7%. African Americans’ presence in Kern County rose during the Dustbowl Migration, which brought migrants from states like Oklahoma, Arkansas, and Texas. Segregation emerged in the designation of the neighborhoods of Cottonwood, Mayfield, and Sunset for African American residence in Bakersfield.

Approximately 100 miles north of San Francisco, Sacramento is the State capitol. Its economy is based in local and State governance, but Sacramento County also runs a $500 million agricultural industry (Mecasland 2017) across 1.5 million acres of farms and was recently designated “America’s Farm-to-Fork Capital” (Darnell, 2019). The city of Sacramento has over 525,000 residents (US Census Bureau 2021). African Americans make up 13.5% of this population, which is twice the percentage of African Americans in California, and white residents comprise 43.5%. From the 1890s through 1950s, as many as 60% of Sacramento’s African American population lived along 3rd street in downtown Sacramento (e.g., the West End) but after WWII, the city received federal aid to compose a Redevelopment Agency to “convert a [so-called] slum and blighted area into a valuable part of downtown” (Lango 2016). The redevelopment agency demolished the West End and forced African Americans into the Oak Park neighborhood through locally accepted redlining practices. By the 1960s, Oak Park had become the hub of Black life in Sacramento and was the center of Black organizing during the Civil Rights movement. Oak Park remains a predominantly Black neighborhood, though gentrification is beginning to change this.

2 Analysis

I analyzed the speech of 28 African American speakers – 18 from Bakersfield and 10 from Sacramento. Speakers were gender-balanced and spanned the entire adult age-range.

Acoustic measurements were taken from the word list portion of the interview, which included the words feel and fill. This was to ensure maximal representation for both vowel classes across all speakers, and if speakers distinguish feel and fill, it is most likely to emerge in careful word list style (Labov 1972). Ultimately, I analyzed 56 tokens of FEEL and FILL.

Word lists were force aligned into word and sound segments using the Penn FAVE-Align software (Rosenfelder, Fruehwald Evanini and Yuan 2011). Praat scripts were created to automatically extract tokens of FEEL and FILL from each interview. All tokens were hand aligned into rhyme segments. I opted to analyze the rhyme, as in the case of l/-controlled vowels, there is no principled way to assess the boundary between the vowel and liquid. The vowel onset and liquid offset were manually adjusted for each token using waveforms in Praat as a guide. The onset of the vowel was marked at the first glottal pulse of the second formant, and the end of the liquid was marked at the cessation of voicing in the waveform.

To examine the contours of FEEL and FILL, I conducted a parametric analysis using Generalized Additive Mixed Models, which accounted for whether FEEL and FILL differed in terms of F1 height, the shape of the F1 contour, or both. I created a PRAAT script to extract 11 measurements across the rhyme. I followed Stuart-Smith et al. (2010) and took F1 measurements at 11 equally spaced measurement points from 0.01% to 100% of the way through the rhyme. These formant values were Lobanov normalized using the vowels package in R (Kendall and Thomas 2010), and normalized values were then measured in the final statistical analysis.

This study used a Generalized Additive Mixed Model (Wood 2017). Like the commonly used Smoothing Spline ANOVA, GAMMs test whether curves are different or not, but since GAMM is based on linear regression, it can be used to represent apparent time changes by measuring continuous independent variables (Soskuthy 2017). The data were fitted to a GAMM (Wood 2017) in RStudio using the mgcv package (Wood 2017) and plotted using the itsadug package (Van Rij et al. 2017). Two models were used to measure the FEEL-FILL merger. One model measured the average (constant) F1 normed difference between the two words using a binary difference smooth. To do this, I created two separate binary difference smooths distinguishing FEEL from FILL with a factor smooth (analogous to a random intercept in linear models) for speaker variability in trajectory shape.
To measure whether the FEEL-FILL contrast differed significantly between African American speakers in Bakersfield and Sacramento, I followed Weiling (2016) and created an interaction term Site*Word with four levels: FEEL and FILL for both Bakersfieldian African Americans and Sacramento African Americans. In this model, F1 was the dependent variable, and the interaction term (Site*Word) was used as the independent variable, with a smooth for trajectory by word, a smooth to represent the difference between the FEEL-FILL contrast for African Americans in Bakersfield and Sacramento, and a factor smooth for speaker.

I created separate models for each factor, rather than a single model, to enable the creation of interaction terms, which are specific to GAMMs. Thus, three additional models were used to measure the effect of social predictors on FEEL and FILL separately. One model included F1 as the dependent variable and independent variables were birth year, word (FEEL or FILL) and their interaction, a tensor-product smooth (i.e., two dimensional and non-linear) interaction between trajectory shape and age, and a factor smooth for speaker. A similar model was used to measure the effect of education level. The third model measured the effect of gender on FEEL and FILL with a factor smooth for speaker.

3 Results

3.1 FEEL and FILL

Statistical analyses of FEEL and FILL revealed no differences between African Americans in Bakersfield and Sacramento, so data for both field sites will be pooled. Previous literature has shown that African American speakers who merge FEEL and FILL typically produce a high-front upgliding vowel, such that even FILL raises and has a diphthongal trajectory (Bailey 2001). The same pattern obtains here, as shown in Figure 1.

![Figure 1: FEEL-FILL GAMM predictions for F1 contours for African American speakers, by vowel class (red = FEEL, purple = FILL).](image)

For the purposes of interpreting the contours, I define the vowel onset as being around intervals 0-2 along the x-axis; the vowel nucleus as being between intervals 2 and 4; the vowel offset as between intervals 4 and 7; the liquid onset around interval 7-9. African Americans exhibit robust overlap, both in terms of height and trajectory, which is diphthongal for both FEEL and FILL. Given that social meaning accrues to each phonological element of the merger (Eckert and Labov 2017), each vowel will be discussed separately for the remainder of this section, and I will conclude with a summary of the findings with respect to the tense-lax distinction before /l/.

3.2 FEEL
The FEEL Gamm modeled F1 trajectory as a function of age and found a significant effect (p<0.001). Figure 2 shows how the F1 trajectory of FEEL has changed over time. The FEEL trajectories show a small difference at interval 3, around the vowel nucleus, where the youngest speakers (purple) exhibit the highest vowel, and the oldest speakers (green) the lowest vowel. The vowel midpoint is raising slightly over time. The trajectories differ significantly between intervals 5 and 7, or at the offset of the vowel. Here, the offset of the vowel in FEEL is lowering over time. Intervals 9 and 10 show that the liquid is also lowering over time. Older speakers have a lower midpoint and higher offset in the FEEL vowel. In other words, older speakers pronounce a laxed [i] to tensed [i], which creates a diphthongal trajectory pattern. The youngest age group is flattening the trajectory of FEEL. Overall, FEEL is lowering over time and its trajectory is becoming less diphthongal.

**Figure 2:** FEEL Gamm predictions for F1 contours for African American speakers, by age group.

Education level also significantly affects the slope of the F1 trajectory (p<0.001). Figure 3 shows how the F1 trajectory varies as a function of education level. Between intervals 1 and 5, or throughout the vowel, FEEL trajectories differ. African American speakers with high school education have a lower FEEL vowel than speakers with college and graduate degrees. For speakers with high school education, the vowel begins as laxed [i] and moves to tensed [i]. It is also worth noting that high school speakers are similar to older speakers, so the change in FEEL is being led by more educated speakers.
As Figure 4 shows, the model indicates a significant effect of gender on F1 for FEEL (p<0.01) with women showing a lighter /l/, as a lighter /l/ is characterized by a lower F1 (Oxley et al. 2006, MacKenzie et al. 2018).

The FILL GAMM modeled F1 as a function of age and found a significant effect (p<0.001). Figure 5 shows how the F1 trajectory for FILL has changed over time. Between intervals 2 and 7, FILL trajectories differ. Older speakers (green) have a high FILL vowel, with an upgliding pattern. The youngest group (purple) are lowering FILL and changing the magnitude of its trajectory. It remains to be seen whether FILL is becoming more monophthongal over time, but the pattern for the youngest speakers (purple) suggests that it is on a path toward flattening.
Figure 5: FILL GAMM predictions for F1 contours for African American speakers, by age group.

The FILL GAMM also modeled F1 trajectory as a function of education level and found that education level significantly effects the slope of the F1 trajectory (p<0.001), as shown in Figure 6. The FILL trajectories diverge in different ways at two critical segments of the rhyme. In the first segment, from interval 1 to 5, around the vowel midpoint, African Americans with college or graduate education (blue) exhibit the highest vowel, and African Americans with high school education (yellow) have the lowest FILL vowel. The trajectories differ significantly again between intervals 5 and 10, where the pattern reverses. Here, the offset of the vowel in FILL is lowest for speakers with graduate education and highest for those with high school education. Speakers with lower education levels have a lower midpoint and higher offset in the FILL vowel. In other words, these speakers pronounce a laxed [i] to tensed [i], creating a more diphthongal trajectory relative to speakers with higher levels of education. It is worth noting again that speakers with a high school education are similar to older speakers, as the flattening of FILL is being led by more educated speakers.

Figure 6: FILL GAMM predictions for F1 contours for African American speakers, by education level.

Gender significantly predicts the F1 trajectory for FILL (p<0.001). As shown in Figure 7, African American women maintain a relatively monophthongal FILL trajectory, as compared to the diphthongal trajectory realized by African American men. While African American men overlap FEEL and FILL in both height and trajectory, African American women maintain a distinction between FEEL and FILL through a flatter trajectory shape of FILL.

4 Discussion

The FEEL-FILL merger has mostly been studied in terms of F1/F2 at one or even two points but studying the FEEL-FILL merger in terms of the vowel contour has nuanced the information about this variable in important ways. Specifically, I showed that the contours of FEEL and FILL are physically indistinct for African American men, but for African American women there are distinctions between FEEL and FILL, particularly at the 20% point of FILL. Had I assessed the vowel trajectory by measuring the difference between 20% and 70% of the way through the vowel, I would have concluded that African American men and women both have a diphthongal trajectory for FEEL.
and FILL. However, the African American women’s FILL contour is flatter, maintaining the phonological distinction, whereas African American men’s diphthongal pattern is in alignment with the Southern Vowel System.

![Figure 7: FILL GAMM predictions for F1 contours for African American speakers, by gender (red = men, purple = women).](image)

Younger speakers were similar to speakers with more education in the realization of FEEL and FILL as less diphthongal. This suggests that the gender pattern is located within a pattern of change. Women are leading the change away from the Southern pattern.

While this is one of the first studies to explore the vowel contour in California, the front lax vowels (which includes FILL) are widely regarded as monophthongal in California English, which suggests that realizing FILL as a diphthong is non-standard. If this is true, then African American women’s monophthongal FILL contour can be understood in terms of the relationship between standardness and the longstanding African American politics of respectability, a term coined by historian Evelyn Brooks Higginbotham (1993:194) to represent the advancement of characteristics such as “hard work, piety, cleanliness, sexual purity and temperance” among Black Baptist women who were working to counter racist images and structures. This view, along with Booker T. Washington’s (1901) philosophy of economic advancement through accommodation has expanded the definitional scope of respectability politics to refer to the emphasis put on African Americans, and particularly women, to represent themselves as respectable to obtain a pathway to social mobility.

For example, in Sacramento, Jamie, 21, who had a monophthongal FILL, felt like she needed to speak more “proper” at work as a para-educator working with kids, and as a student: “I definitely speak like more proper like at work or school than I do when like I’m out or something like that with friends.” The emphasis on respectability politics experienced by African American women could also be understood as an expectation for African American women to be articulate while Black (Alim and Smitherman 2012), or put another way to heed the pressures of standard language ideology in a given community. Tiara, 47, also discusses adopting the speech patterns of the White Bakersfield community in the following excerpt: “With the way I talk and the way my sister talks is like a lot of Valley Girl with a lotta southern stuff mixed in”. As President Barack Obama writes in his first book, “members of every minority group continue to be measured largely by the degree of our assimilation [to Whites]”. What makes this social pressure distinct for African American women is that they experience limited economic mobility in the country (Akee et al. 2017), because of how their racialized and gendered identities intersect. If we adopt King’s (2018) notion of multidimensionality, which is the view that racialized speakers negotiate their identity via language, we might say that African American women are negotiating their identity using the vowel contour. Whether the diphthongal vowel contour is used as an index of or claim to Black identity remains an open question.
References


Zion Mengesha
Department of Linguistics
Stanford University
Stanford, CA 94305-2150
zmengesh@stanford.edu