VARIATION IN AFRICAN AMERICAN ENGLISH: THE GREAT MIGRATION AND REGIONAL DIFFERENTIATION

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ABSTRACT

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While African American English is among the best studied language varieties, it was historically taken to be relatively uniform, and it is only recently that regional variation in AAE has become an object of sustained study among sociolinguists. There has been as of yet no comprehensive, large-scale description of regional variation in AAE comparable to existing descriptions of white varieties of English, like that in the *Atlas of North American English* (ANAE). In this dissertation, I provide the first ever analysis of regional variation in the AAE vocalic system, across the United States, arguing that there is considerable regional variation in AAE, that it patterns with movement of people during the Great Migration, and that it cannot be characterized solely by the presence or absence of the proposed African American Vowel Shift. To do so, I introduced a novel reading passage specifically designed to elicit naturalistic AAE speech, read by hundreds of participants across the US, and apply traditional sociophonetic methods, spatial statistics, and clustering analyses.

Contents

Chapter 1

Introduction

1.1 Introduction

In this dissertation I investigate regional variation in African American English (alternately, AAE) after the Great Migration. Using new recordings of African Americans from across the country, reading a new reading passage specifically designed to elicit AAE, I have been able to describe the vowel spaces of African Americans across the country, and compare them, with novel and interesting results. Specifically, I found that, contrary to previous claims in the literature, AAE is not homogeneous; that there are distinct dialect regions in AAE; and that these regions correspond to pathways of movement during the Great Migration.

This research is unique for three reasons. First, it is the first ever comparison of vocalic systems of African Americans across the entirety of the United States. While many previous studies have made a direct comparison between African American and European American vowel systems in one location – usually with a focus on only one or two vowels – this is the first ever study of regional variation in AAE as a system. While I do draw a comparison between the regional patterns in European American English established in the *Atlas of North American English* (ANAE), this is the first ever attempt at a complete description of AAE as a spatially coherent system.

Second, my use of new statistical methods not only allows a clear picture of regional variation in AAE to emerge, but also allows for a more nuanced understanding of regional variation in European American English in the ANAE. More importantly, the methodological advances presented here facilitate direct comparison across these very different data sets. Moreover, the use of hierarchical clustering models to create a phylogenetic tree of AAE variation provides a clear picture of the interaction between population movement and language variation and change.

Lastly, this research helps provide a better understanding of both the role of the Great

Migration in linguistic change in AAE in the last decades, and also the possible impacts of segregation, discrimination, and Jim Crow on language evolution.

My methods and results are relevant to a broad range of questions, beyond mere description of the envelope of variation in AAE. The approaches I use to evaluate regional variation are broadly applicable to future sociolinguistic and dialectology research. I also developed new statistical approaches to the investigation of diphthongs, which will be of use to sociolinguists and phoneticians. My results are relevant not just to scholars of African American English, but also to anyone studying linguistic variation and change – AAE has provided a unique window into real-time change, as the Great Migration has only recently ended, and is well documented.

My results are challenging to the views that African American English can be treated as a single, unified whole. They create significant problems for arguments for koineization and supra-regional unifying characteristics. Much of the literature on AAE seeks to explain how and why AAE speakers local to a particular place accommodate or diverge from patterns happening in the speech of local whites. This approach centers local white varieties as a benchmark against which to measure AAE, which I argue is not the best, and should certainly not be the only approach to investigating AAE. This narrow view fails to situate local AAE speech in the broader context of regional patterns in AAE, and lends itself to either supporting the view that variation in AAE is not systematic, but rather is definable as it occurs in response to local white varieties. It also lends itself to a universalizing view of AAE, where individual local changes can potentially be taken to be characteristics of African American English as a whole. As I make it clear in subsequent chapters, AAE exhibits systematic internal regional variation, much of which is best explained without any recourse to local white varieties, especially insofar as the Great Migration was met in the destination cities with a backlash consisting of residential and school segregation and white flight.

The dissertation is laid out as follows. In chapter 2, I survey the relevant literature. I start by providing an overview of the state of the research on African American English. I then introduce relevant background on dialect geography and spatially informed study of linguistic phenomena, as well as the existing research on language variation and change in space. I conclude by surveying the sparse literature on regional variation in African American English.

In chapter three, I bring new methodological approaches to bear on a classic data set, the Atlas of North American English. My goals in this chapter are threefold. First, I demonstrate that the new statistical methods I use allow us to investigate regional variation in well known data, drawing out new and interesting findings while eliminating the bias introduced by hand coding. Second, I demonstrate that while these methods can provide interesting new details, they also corroborate – and are corroborated by – the traditional, "gold standard" approach of the ANAE. That is, I demonstrate in this chapter that these new methods, applied to the ANAE, produce the expected results, supporting their trustworthiness when applied to new data in chapter 4. Lastly, I provide an approach to variation in the ANAE that facilitates direct comparison to the data for African American English.

In chapter four, I apply the same methods to the study of regional variation in AAE. Using the results from my demographic survey and reading passage, I provide the first ever national view of vocalic variation in AAE. I demonstrate that, contrary to previous claims, the vocalic system of AAE is neither homogenous, nor does it exhibit random variation. Rather, there are highly structured regional patterns to AAE vowel systems which correspond to pathways of transit during the Great Migration. I demonstrate that the purportedly universal African American Vowel Shift (AAVS) is a phenomenon constrained primarily to the region from the western part of the Gulf of Mexico up the Mississippi toward the Great Lakes, and to the Piedmont region of the Carolinas. I also investigate a phylogenetic clustering approach to grouping AAE dialect regions.

In chapter 5, I compare regional variation in African American and European American Englishes. While it has long been known that African Americans only variably participate in local shifts occurring in the speech of nearby European American English speakers, the degree to which AAE speakers exhibit accommodation toward or divergence from local white norms has not been systematically explored. Here, I demonstrate that regional patterns in AAE are largely *literally* orthogonal to ongoing changes in white Englishes. I also investigate the relationship between local segregation and accommodation and divergence, arguing that one driver of the different patterns of regional variation in AAE, as compared to European American Englishes, is the ongoing effects of Jim Crow, segregation, and racism.

In chapter Chapter 6, I provide conclusions, again arguing that African American English is not homogeneous, that it exhibits spatially ordered inhomogeneity, that dialect regions in AAE mirror the Great Migration, and that we see different dialect regions in AAE than white Englishes in part because residential and school segregation made accommodation following the Great Migration largely impossible.

Chapter 2

Literature Review

2.1 Introduction

The present dissertation is a study of regional variation in African American English vowel systems. AAE provides a unique opportunity to further both our understanding of a stigmatized variety that is often taken to be uniform (especially among laymen), and our understanding of the role of space in linguistic diffusion and change over a short time frame. Many of the places AAE is currently spoken had few or no African Americans 100 years ago. Following two waves of migration out of the South, primarily to industrialized northern cities, collectively referred to as the Great Migration, African Americans are now spread across the US. While their paths of migration cut across well established patterns of regional variation in European American English, Jim Crow laws, block-busting, red-lining, and the resulting residential, educational, and social segregation means that in many destination cities, African Americans historically had little or no opportunity to interact with other racial groups, and by extension, little or no opportunity to interact with speakers of other dialects. It is well known in sociolinguistics that African Americans do not generally participate in the ongoing Northern Cities Vowel Shift, for example. Given a historical isolation index[1] of 99 in Chicago, this is perhaps unsurprising. AAE is therefore an excellent case to investigate linguistic drift and language change as relates to population movements: following one of the largest migrations of people in history, we can now observe both geographic propagation and linguistic change as it emerges.

At the time AAE was receiving the first rigorous academic treatments, the Great Migration was still underway. Much of the early descriptions of 'Northern Negro English', 'Black English Vernacular' and 'African American Vernacular English' found that what we now refer to as AAE (or AAL, see section 2.2, below) was remarkably uniform across the country.

[1]The Isolation Index is one of a number of statistical indices of segregation, in this case representing expected level of contact between groups. A score of 1 corresponds to total segregation, a score of 0 corresponds to total integration (Massey and Denton, 1988).

However, this foundational research was undertaken in the late 1960s, and the migration did not end until the 1970s. (Harrison, 1992; Tolnay, 2003; Wilkerson, 2011). Now, exactly 50 years later, there is significant regional variation in AAE, however it is understudied and has not yet been described. Until recently, studies of AAE might investigate a particular sociolinguistic variable (say, vowel centralization before /r/) in a particular place (say, St. Louis). These are important studies that further our understanding of language variation and change. However, there is not a clear picture of AAE regional variation we can situate these studies in relation to. For instance, when Blake et al. (2009) discuss the increasingly enregistered vowel centralization before /r/ in St. Louis, it is not clear how this relates to broader patterns in AAE. Are these the same patterns of centralization as in Washington D.C. and in Baltimore? How do these patterns in these cities relate to one another? Are they independent, parallel developments? The result of supraregional koinezation?

While there are individual voices suggesting AAE is not (or is no longer) monolithic (Labov, p.c.; Wolfram, 2007), it was not until after Jones (2015b) attempted a national description of AAE lexical variation using social media data that there was a sudden explosion of conference talks and papers examining regional variation in AAE (Austen, 2017; Mitchell et al., 2017; Wolfram and Kohn, 2015), or situating local varieties in terms of broader patterns of migration (Arnson and Farrington, 2017; Farrington et al., 2017; Farrington and Schilling, 2019; Holliday, 2019). The Corpus of Regional African American Language (Kendall, 2018) seeks to remedy this by unifying various corpora and producing new corpora from around the country, however at present only Washington D.C., Princeville, NC, and Rochester, NY are available. As such, a new study was necessary.

This dissertation seeks to describe the broad regional patterns of variation in AAE vowel systems following the Great Migration, and, with the aid of contemporary statistical methods, to use these patterns as a window into language evolution.

2.2 African American English

African American English (AAE, alternately *African American Language*, AAL[2]) is one of the best studied language varieties despite the relatively late development of interest in it on the part of academic linguists – the first influential discussions of AAE that treated it as a legitimate language variety and object of study are from the late 1960s, after the passage of the Civil Rights Act (Fasold and Wolfram, 1972; Houston, 1969; Labov, 1968, 1972a; Legum et al., 1971; Mitchell, 1969; Wolfram, 1969). While it is now often the subject of varied and thriving research, there is much that is still unknown. Because of the long and painful history of institutionalized anti-black racism in the United States and the late interest in AAE as linguistics moved increasingly into the natural sciences (especially cognitive science) and away from philology and outmoded racial pseudo-science common to linguistic analyses in the 19th and early 20th centuries, aspects of the history, structure, development, and trajectory of AAE are still unknown, and in some cases unknowable. The exact origin of the variety remains unknown, and there is still no consensus on whether it is basically 'English' derived from that of white Southerners (the so-called *Anglicist* and *neo-Anglicist* hypotheses (Kurath, 1949; McDavid and McDavid, 1951; Montgomery et al., 1993; Montgomery and Fuller, 1996; Mufwene, 1996; Poplack, 2000; Poplack and Tagliamonte, 2001)), fundamentally not English (the *Creole Origin* hypothesis (Dillard, 1973; Rickford, 1998; Stewart, 1967)), or something entirely different altogether, outside of the *English-or-Creole* paradigm (the *Substratist* (Wolfram, 2003; Wolfram and Thomas,

[2]The name *African American Language* is gaining in popularity. Defined by Lanehart (2015) informally as "how African Americans do language," it sidesteps debates around the essential character and historical origin of the variety and whether it's essentially *English*, as well as allowing researchers to discuss a range of linguistic practices that may be different from AAE as traditionally conceived – e.g., intonational contours specific to middle-class African Americans who are otherwise ostensibly speaking Mainstream US English (MUSE). Here, I use AAE, but with the caveat that I am *not* taking a stance on the origin of the language variety, and not assuming the Anglicist hypothesis. I use AAE in part because it will be more familiar to a broader readership, in part because I do not wish to exoticize the language variety in question, and in part because AAL is potentially inclusive of a wider range of linguistic varieties than under discussion here (e.g., *Gullah*, a Creole language spoken by some African American communities in the Southeastern United States.)

2008) and *Ecological* (Mufwene et al., 2001) approaches). Its trajectory is also a source of controversy, with arguments for *convergence* to and *divergence* from the norms of (white) Mainstream United States English (MUSE) finding voice (see Fasold et al., 1987, for an overview). Moreover, the wealth of research conducted in the last six decades is largely of two types: either focused on ostensibly universal defining features that distinguish AAE from other varieties (e.g., habitual *be*) or hyper-local investigations of individual changes in progress (e.g., studies of /r/ vocalization focusing on change in apparent time in AAE communities in one or two cities (Blake et al., 2009; Labov, 1968, 1972a; Wolfram, 1969)). As of yet, there has been no thorough characterization of regional variation in AAE, despite the fact that as Labov (2014) notes, AAE clearly does not always follow the same patterns of ongoing linguistic change we see in regional white varieties.

Increasingly, there is a push toward recognizing that AAE is heterogenous both across social classes and communities of practice, and across geography. Linguists are beginning to examine variation in AAE on the supra-urban level, and some are working toward building a corpus of regional AAE, although such a corpus does not yet exist (specifically, Tyler Kendall and the LVC lab at the University of Oregon are building a Coprus of Regional African American Language (CORAAL) project,[3] building on Wolfram & Kendall's North Carolina State University housed corpus, the Socio-Linguistic Archive and Analysis Project (SLAAP)[4]).

While the above competing hypotheses about the origins of AAE make specific structural claims about the development of AAE, regardless which position one takes, it is clear the language variety developed as a result of chattel slavery in the United States. AAE has some distant relation to the Plantation Creole forced upon enslaved West Africans who ultimately ended up in the New World. Furthermore, regardless whether one treats AAE as a Creole

[3]http://blogs.uoregon.edu/lvclab/enhancing-data-and-tools-for-research-and-education-on-african-american-english/

[4]https://slaap.chass.ncsu.edu/

that has decreolized, or a variety of English with rich West African linguistic influences, the speakers of AAE – especially the most divergent varieties of AAE – were historically, and remain, largely segregated from white English-speaking populations. Following the collapse of Reconstruction after the Civil War, Jim Crow laws imposed strict segregation in all aspects of American life. While "separate but equal" fell, at least as the law of the land, in one domain after another, its effects are still felt today. Schools ostensibly began desegregating following Brown v. Board of Education of Topeka, in 1952, however recent studies have found that schools never fully integrated, and in many cases are now more segregated than when integration started (Denton, 1995; Kohli, 2014; Stancil, 2018). Similarly, redlining, block-busting, and residential segregation became illegal in 1974, however this was not followed by a mass residential reshuffling, meaning that current neighborhood racial boundaries are largely still shaped by Jim Crow. Especially in cities in the North, the United States remains *de facto*, if not *de jure*, racially segregated. It is therefore reasonable to believe that AAE has been developing on its own, with varying degrees of contact with other varieties depending on a variety of sociological and geographic factors.

2.2.1 Some Features of AAE

African American English is sometimes taken to be a distinct "module" that can be thought of as a coexistent system with, or add-on to, some version of MUSE (Labov, 1998), although this is a controversial approach.[5]

African American English features have been described in all linguistic domains, so there are well-known phonological and phonetic features, morphosyntactic features, and

[5] In part, this is controversial because some see it as privileging MUSE as the core morphosyntax, and argue that it would be just as possible to treat AAE as core, and MUSE as lacking certain morphosyntactic features and phonological processes. While this argument makes a certain amount of sense from the synchronic perspective, it is certainly not accurate from a diachronic perspective.

lexical, semantic, and pragmatic features, although much of the focus in sociolinguistics has been on the phonology and morphosyntax, and comparatively little has been on lexical items, semantics, and pragmatics (although, see Rickford and Rickford, 2000; Smitherman, 1998; Spears et al., 1998, for discussion of lexical items in particular).

The phonological and phonetic features of AAE described in the early literature have been subsequently taken to be universal, and characteristic of AAE. Among them are the PIN-PEN merger, in which /i/ and /e/ are merged[6] before nasals (generally to /i/) (Bailey and Thomas, 1998; Schneider, 2008; Thomas, 2007; Thomas and Bailey, 2015); AY-MONOPHTHONGIZATION, in which /ay/ is monophthongized to [ɑː], although in AAE not before voiceless consonants (Fridland, 2003; Nguyen, 2006; Schneider, 2008; Scanlon and Wassink, 2010; Thomas, 2001, 2007; Thomas and Bailey, 2015); cluster simplification, in which homorganic postvocalic consonant clusters reduce (Bailey and Thomas, 1998; Green, 2002; Thomas, 2007; Thomas and Bailey, 2015); so-called G-DROPPING, in which the final consonant in word final -ING is realized as non-velar (Bailey and Thomas, 1998; Green, 2002; Labov, 1968; Thomas, 2007; Thomas and Bailey, 2015); vocalization or deletion of postvocalic /r/ (Bailey and Thomas, 1998; Fasold and Wolfram, 1972; Green, 2002; Labov, 1968; McLarty et al., 2019; Thomas, 2007; Thomas and Bailey, 2015); vocalization of postvocalic /l/ (Bailey and Thomas, 1998; Fasold and Wolfram, 1972; Green, 2002; Labov, 1968; Thomas, 2007; Thomas and Bailey, 2015); and TH-FRONTING and TH-STOPPING in which /ð/ and /θ/ are realized as /d/ and /f/ respectively (Bailey and Thomas, 1998; Cutler, 1999; Eisenstein, 2013; Green, 2002; Jones, 2015b, 2016b; Labov, 1968, 2014; Labov and Fisher, 2015; Thomas, 2007; Thomas et al., 2010; Rickford, 2015; Rickford et al., 2015; Sneller, 2019). Understudied features include nasal segments realized as nasalization on preceding vowels (Carignan et al., 2011; Edwards, 2008; Green, 2004; Pollock and Meredith, 2001; Wolfram, 1989); V-LENITION, in which postvocalic /v/ is lenited or deleted, as in

[6] Here, and throughout, I follow Labov's use of *binary notation*, explained below, in section 2.3.2

love [lʌː] or *believe* [bəliː] (Jones, 2015a; Thomas, 2007), YOD-DROPPING in words like *inaguration* (Bailey and Thomas, 1998); and fortition of sibilants in certain contexts (e.g., *wasn't* [wʌdn̩ˀ], (Schilling-Estes, 1995)). Increasingly of interest to sociophoneticians are differences between AAE and other varieties in terms of suprasegmental features, especially pitch contours (Holliday, 2019; McLarty, 2018; Thomas, 2015). Secondary glottalization of post- and inter-vocalic stops is also an increasingly popular domain of study in AAE, as are debuccalization and total deletion (Farrington, 2018; Jones et al., 2019; Thomas, 2007).

AAE also exhibits a number of distinguishing morphosyntactic features. Among them are copula deletion in the present tense (Fasold, 1972; Green, 2002; Labov, 1968, 1972a, 1998; Wolfram, 1974); HABITUAL 'BE', where uninflected *be* is used as a habituality marker (Fasold, 1972; Green, 2002, 2010; Jones et al., 2019; Labov, 1968, 1972a, 1998; Thomas, 2007; Wolfram, 1974);; STRESSED 'BIN', where *been* is used to indicate remote perfect (Dayton, 1996; Green, 1998, 2002; Rickford and Rickford, 2004);[7] PRETERITE 'HAD', in which *had* does not indicate pluperfect, but rather is used for narrative focus in the preterite (Rickford and Rafal, 1996); negative concord (Green, 2002, 2014; Walker, 2005); negative auxiliary inversion (Green, 2002, 2014; Jones et al., 2019); quotative *talkin' 'bout* (Jones, 2016a); so-called INDIGNANT 'COME', where *come* does not indicate motion, but rather speaker stance (often used in conjunction with quotative *talkin' 'bout*) (Jones, 2016a; Spears, 1982); use of *be done* constructions (Labov, 1972a; Green, 2002); and various mophological reductions in the context of negation (Jones, 2015a), among others. So-called CAMOUFLAGE CONSTRUCTIONS, in which familiar MUSE lexical items mask radically different AAE syntactic and semantic structures are still being discovered by academic linguists (Collins et al., 2008; Jones, 2015a, 2016a; Jones et al., 2019; Rickford and Rafal, 1996; Spears, 1982; Wolfram, 1994).

[7]The range of meanings and uses of stressed *bin* is actually significantly more complex than this, and is a source of ongoing debate and discussion (see, for example, Spears, 2009; Spears et al., 2015)

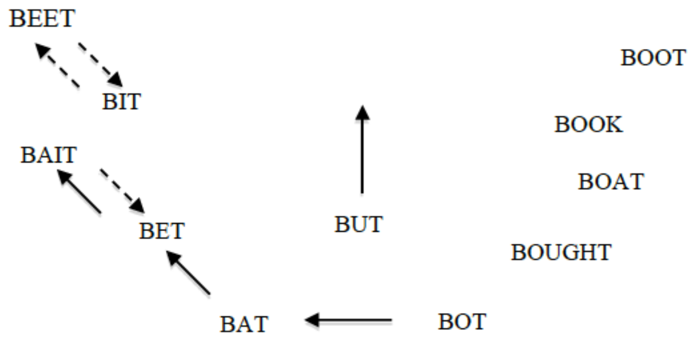


Figure 2.1: The African American Vowel Shift (after (King, 2016)

AAE also exhibits lexical, semantic, and pragmatic differences that go far beyond passing slang. Some differences described in the literature include core words for African American skin and hair care (e.g., *ashy*, *kitchen*, and *edges* (Labov, 1968), and evaluatives for people, like *saditty*, *hotep*, and *bougie* (Rickford and Rickford, 2000; Smitherman, 1998; Spears et al., 1998).

In recent years, some researchers have also argued for an African American Vowel Shift (AAVS) (Bailey and Thomas, 1998; King, 2016; Kohn and Farrington, 2013; Thomas, 2007; Yaeger-Dror and Thomas, 2010) and a subset have argued it may be universal in AAE (e.g., Thomas, 2007, who claim it is present in speakers from both North Carolina and Brooklyn, New York.). The proposed shift was first described in North Carolina, and is characterized by reversal of the nuclei of /ey/ and /e/, a possible reversal of the nuclei of /iy/ and /i/, raising and fronting of /æ/ toward /ey/, fronting of /o/ toward /æ/, and raising of /ʌ/ (figure 2.1).

While the AAVS is claimed to be universal, it conflicts with details in a number of studies (e.g., Labov, 2014, on /æ/). However, there is not yet any definitive description of regional variation in AAE, so it is unclear where and to what extent the AAVS is valid. In the next section I discuss dialect geography before turning my attention to regional variation in AAE.

2.3 Dialectology

While this dissertation is not merely an exercise in dialect geography, it will be necessary to situate it with regards to dialectology and dialect geography. Dialectology is a sub-discipline of sociolinguistics concerned with the study of *dialects*. "Dialect," as Chambers points out, is a term used by linguists in "essentially an ad hoc manner," (Chambers and Trudgill, 1998), and can be viewed in terms of subdivisions of a given language variety in terms of accent, lexical choice, and syntax, geographic continua, social continua, and ethnic differentiation, among others (see Chambers and Trudgill, 1998, for an overview). Perhaps the best known statement on the subject of defining *dialect* contra *language* comes from Weinreich (1945): *a shprak is a dialekt mit an armey un flot* 'a language is a dialect with an army and navy.'

African American English is generally thought of as an *ethnolect*: a kind of dialect associated with a given ethnic group, irrespective of geography. In fact, most introductory texts to sociolinguistics use AAE as an example to teach the concept of *ethnolect* (viz, e.g., Van Herk, 2012). However, the rest of this dissertation is a sustained assault on the idea that African American English can be thought of as one unified ethnolect – rather, it will be shown that there is considerable and highly structured geographic variation in AAE.

2.3.1 Origins

Discussion of geographic variation in language is not new. Indeed, we find discussion of accent differences in the Hebrew bible (Judges 12:6). However, the systematic study of regional variation did not begin until the second half of the 19th century, with two massive projects in Europe.

The first large scale study of dialect geography was performed by Georg Wenker, starting in 1876, although the first publication from his work did not come until 1881, and the full *Deutscher Sprachatlas* was not published until 1927 (Wenker, 1881; Wrede et al., 1927;

Chambers and Trudgill, 1998). It was made available online in 2009.[8] Wenker sent lists of forty sentences written in standard German to German school teachers, and asked them to return the lists transcribed in the local dialect. A typical example is *Im Winter fliegen die trocknen Blätter durch die Luft herum* 'In winter the dry leaves fly around through the air' (Wenker 1927, translation after Chambers 2004). He sent out 50,000 such lists, and received an overwhelming 45,000 responses. A number of other such projects were inspired by Wenker's methodology, including in Denmark, Scotland, and Canada (Chambers and Trudgill, 1998).

In contrast to Wenker's methodology, the first use of trained fieldworkers was in France, begun in 1896 by Jules Gilliéron, and performed in large part by the delightfully named Edmond Edmont. As Chambers notes, Edmont was originally a grocer, however he was "chosen for the astuteness of his ear, and was trained to use phonetic notation" (Chambers and Trudgill, 1998). As Chambers and Trudgill (1998) explains:

> "From 1896 to 1900, he cycled through the French countryside selecting informants and conducting interviews. When he finished, he had recorded the results of no fewer than 700 such interviews at 639 different sites. It is never clear whether the informants he chose formed a fairly homogeneous social group by choice or by chance, but of the 700 informants, only sixty were women and only 200 were educated beyond the norms of the rural population of the time. Edmonts results were sent to Gilliron and his assistants periodically, and were incorporated into their analysis. In this way, publication got underway almost immediately, beginning in 1902; the thirteenth and final volume was published in 1910."

This project is now available digitally.[9] When originally published, it too, inspired a

[8] https://www.regionalsprache.de/

[9] http://lig-tdcge.imag.fr

number of subsequent research projects, including atlases of Italian and Southern Swiss dialects, and the Linguistic Atlas of the United States and Canada (LAUSC), which was coordinated by Hans Kurath, and was divided into volumes based on region, beginning with the *Linguistic Atlas of New England*.[10]

Dialect geography arose in part as an empirical test of, and challenge to, the absolutist dogma of the *jungrammatiker* (or *neogrammarians*), who maintained the exceptionlessness of sound change following the exciting discovery of Verner's Law, resolving an apparent exception to Grimm's Law (Jankowsky, 2019; Osthoff and Brugmann, 1880; Paul, 2010). Dialect geography became a spatial test of the exceptionlessness of sound change. Dialect geographers make use of visual representations of spatial variation in language data, especially in the form of maps, and maps with *isoglosses*. An isogloss (Bielenstein 1892, cited in Chambers and Trudgill, 1998) is a line drawn on a map dividing a region in which one variant is used from that where another is used.[11] A key finding was that sound change did not always appear to be regular, resulting in the dialectologist's slogan "every word has its own history" (Labov, 1981; Malkiel, 1964, 1967).

2.3.2 Modern Questions

Following the revolutions in linguistics ushered in by Chomsky and Labov, the questions that linguists asked of space and place began to change. Especially in sociolinguistics, the questions of interest to researchers are now centered around the questions of the actuation of linguistic change, and mechanisms of spread (Herzog et al., 1968). As Trudgill put it:

> "...dialectologists should not be content simply to *describe* the geographical distribution of linguistic features. They should also be concerned to *explain* – or

[10] This, too, is available digitally, at http://www.lap.uga.edu/

[11] Effectively, this is a manually drawn approximation of a nonlinear two-dimensional classification boundary, performed by eye without using mathematics

> perhaps, more accurately, to adduce reasons for – this distribution. Only in this way will we be able to arrive at an understanding of the sociolinguistic mechanisms that lie behind the geographical distribution of linguistic phenomena, the location of isoglosses, and the diffusion of linguistic innovations. If we are to achieve this understanding we need to be able to say exactly *why* and *how* linguistic features, under linguistic change, are diffused from one location or social group to another." (Trudgill et al., 1974)

Until the middle of the 20th century, the standard theoretical model of linguistic diffusion was the WAVE MODEL: linguistic innovations begin, somehow, in one place, and are gradually adopted by those near the source of innovation. As more people adopt the innovation, its geographic footprint spreads, like a wave, outward from the source. Subsequent changes, if the innovation perhaps triggered subsequent changes, as in a chain shift (Labov, 1994), would occur first where the initial innovation already had, and would spread outward again from the epicenter of change. In this way, a chain shift might spread like ripples in a pond.

This model of spatial diffusion was challenged in non-linguistic contexts by Hägerstrand (1952, 1965a,b, 1966, 1967a,b), who wrote "When studying changes we cannot draw boundary lines and observe their displacements" (Hägerstrand, 1952). This was developed in a linguistic context by Trudgill et al. (1974), who argued that dialectologists should abandon the wave model in favor of ascertaining the spatial diffusion of ratios. Rather than a wave model, Trudgill proposes a GRAVITY MODEL or CASCADE MODEL, in which diffusion of linguistic innovation is expected to spread "down the urban hierarchy" (Chambers and Trudgill, 1998), rather than outward spatially. This means that we may expect linguistic diffusion to "jump" from city to city – originating in a high population center, say, Chicago, and being transmitted next to the next largest population centers *before* trickling down to the geographically intervening towns. This model resolved a number of thorny problems that the wave model could not explain, most famously, explaining the spatial diffusion of uvular

/r/ in continental Europe (Trudgill et al., 1974; Chambers and Trudgill, 1998).

The introduction of the cascade model, combined with Labov's insight that we can (and should) distinguish abstract phonological change from low-level output rules (Labov, 1981) , effectively resolved the neogrammarian paradox – that sound change is, ultimately, regular, given a sufficient time frame, but also that the spatial and social borders of a change in progress are messy, and that every word does indeed seem to have its own (phonological) history.

These conceptual advancements coincided with significant technological and methodological advancement, including the rise of audio recording technologies that sociolinguists make heavy use of, so, while impossible for Wenker or Gilliéron, linguists like Trudgill and Labov could reasonably believe it possible (if not necessarily feasible) to acquire a sufficiently large sample of audio recordings to instrumentally investigate linguistic change on a large scale.

It was in this modern context that the *Atlas of North American English* was compiled (Labov et al., 2005). The ANAE made use of a recorded telephone survey conducted in the 1990s, analyzed, and published in the early 2000s. While there are a number of other such studies, the ANAE remains the "gold standard" in dialect geography (Doyle, 2014). While the ANAE illuminates regional variation in North American English, including a number of on-going changes in progress, it is also limited by the fact that the sample was intentionally working class *white* speakers of English. Because the researchers were never able to attain sufficient funding to carry out the same research on a sizable sample of African American English speakers, regional variation in AAE is not discussed at length in the AAE, and regional variation in AAE vowel systems remains uncharted. The ANAE will be discussed at length in chapter 3. Here, though, I will add that like the ANAE, this dissertation makes use of a binary system of notation, following American philologists, starting with Bloomfield (1933). In this system, after Labov et al. (2005):

	SHORT		LONG					
			Upgliding				Ingliding	
			Front upgliding		Back upgliding			
	V		Vy		Vw		Vh	
nucleus	front	back	front	back	front	back	unrounded	rounded
high	i	u	iy		iw	uw		
mid	e	ʌ	ey	oy		ow		oh
low	æ	o		ay		aw	ah	

Figure 2.2: Binary notation, after Labov et al. (2005)

> "A binary notation makes two kinds of identification. Front upglides of varying end-positions [j, i, ɪ, e, ɛ] are all identified as /y/ in phonemic notation. Similarly, the back upglides [w, u, ʊ, o, ɤ] are identified uniformly as /w/. Secondly, the nuclei of /i/ and /iy/, /u/ and /uw/ are identified as 'the same.' Such an identification of the nuclei of short and long vowels is a natural consequence of an approach that takes economy and the extraction of redundancy as a goal. The same argument can be extended to the nuclei of /e/ and /ey/, /ay/ and /aw/.In the binary system, short vowels have only one symbol, which denotes their nuclear quality, while long vowels have two symbols. The first denotes their nuclear quality, the second the quality of their glide. There are three basic types of glide at the phonemic level: front upglides, represented as /y/, back upglides (/w/), and inglides or long monophthongs (/h/)."

This system not only simplifies notation and makes a lax-tense distinction redundant, but it also reflects diachronic structural organization of the vowel space and allows us to situate AAE vowels relative to white varieties in the ANAE and even vowel classes going back to Middle English. A table of the vowels of English in this system is presented in figure 2.2. The interested reader is referred to the *Atlas of North American English* for further elaboration on this system and its benefits.

In the next section, I discuss what is known of regional variation in AAE in the existing literature. Following Trudgill's call, above, in chapter 4, I will *describe* regional variation in AAE – something never before done systematically on a national scale – and in chapter 5, I will attempt to *explain* ('or adduce reasons for') these patterns.

2.4 Regional Variation in AAE

While there are a handful of studies on regional variation in AAE on a small scale (Lee, 2016; Wolfram and Kohn, 2015; Wroblewski et al., 2009), to my knowledge the only attempts at a national-level characterization of regional variation in AAE are those performed by Jones (2015b), and by Austen (2017), replicating and corroborating Jones (2015b). Comparing individual papers and books about individual AAE features in specific locales, however, a picture of national variation in AAE begins to emerge.

For instance, it is known that there is regional variation in the production of postvocalic /r/; vocalic mergers before /r/; the PIN-PEN merger; switching postvocalic /l/ and /r/; TH-stopping TH-fronting; devoiced, debuccalized, and glottalized word final and word internal stops; the pronunciation of /æ/; participation (or non-participation) in local white sound shifts; enregistered terms of address; and even some supposedly core syntactic features. These will be discussed in turn, below.

Variation in postvocalic /r/ is a favorite topic of study of sociolinguists, especially those investigating AAE. Studies of AAE in different locations attest to everything from near categorical absence to categorical presence of postvocalic /r/. A non-exhaustive survey of such studies, from absent to present, includes Detroit (Wolfram, 1969), New York City (Labov, 1968, 1972a, although cf. Blake et al. 2009), Philadelphia (Labov, 1972a), Washington D.C. (Annon, 2016; Arnson and Farrington, 2017), Memphis & St. Louis (Blake and Shousterman, 2010), and Idaho (Riney, 1990).

Similarly, a number of different vocalic phenomena, including centralization and merger, have been described before /r/. These include low-back merger to [ɑ] in New York City, low-back merger to [ɔ] in Philadelphia (Labov, 2014), centralized/vocalic /r/ in Washington D.C. (Arnson and Farrington, 2017), and centralized/vocalic /r/ in Memphis and St. Louis (Blake and Shousterman, 2010).

The PIN-PEN merger, is usually taken to be categorical and a stereoptyical feature of AAE, but is not present in my pilot sample of speakers from Harlem, NY and Jersey City, NJ used in my dissertation proposal (e.g., “I *been* [bɛn] told you that”). It appears not to be as consistent in AAE as once thought (viz. inter alia Coggshall and Becker, 2009; Eberhardt, 2009; Purnell, 2009; Rickford and Price, 2013; Thomas, 2007; Wroblewski et al., 2009), with a small but growing number of studies in communities for which it is absent, or not categorical, including in California (King, 2016), and Philadelphia (Jones et al., 2019).

There is also evidence for ‘swapping’ of postvocalic /l/ and /r/, evidently only in a band stretching from Jackson, MI to Chicago, IL, but not in the Northeast, or West (Jones, 2015b, 2016b). This is a stereotype of black speech in earlier writing, but has not been discussed in the modern literature on AAE to my knowledge except by Jones (2015b, 2016b) and by Troike (2015).

There is evidence of regional variation in TH-fronting and TH-stopping, with Philadelphia exhibiting fronting to [f] in words like *nothing* (Jones, 2015b; Sneller, 2014), Washington DC fronting to /f/ (Jones, 2015b) New York exhibting TH-stopping in the same environments (Jones, 2015b), and southern US TH-stopping, which may then feed glottalization (Jones, 2015b; Thomas, 2007).

There is a growing body of evidence for devoiced and/or glottalized word final[12] stops in the southern US (Jones, 2015b; Thomas, 2007), and in Washington D.C. (Arnson and Farrington, 2017; Farrington, 2018).

There is also limited evidence for regional variation in the pronunciation of /æ/. In

[12]There is evidence that this now includes word medial stops, but more research is needed.

Philadelphia, it is raising and laxing (counter to raising and *tensing* in white Philadelphia varieties) (Labov, 2014; Labov and Fisher, 2015). In Bakersfield, CA, it is backing (King, 2016). In North Carolina, it is raising and tensing (Bailey and Thomas, 1998; King, 2016; Kohn and Farrington, 2013; Thomas, 2007; Yaeger-Dror and Thomas, 2010).

Participation, or non-participation in local white sound changes in progress also varies significantly. African Americans are generally not participating in the Northern Cities Vowel Shift (Labov et al., 2005). Likewise, they are not participating in Philadelphia /æ/ tensing (Labov, 2014; Labov and Fisher, 2015), however they are participating the in low-back merger before /r/ in Philadelphia (Labov, 2014; Labov and Fisher, 2015). There is also evidence for participation in the fronting of back vowels in Washington DC (Lee, 2016).

There is also a wide range of enregistered (Agha, 2003, 2005) local and regional lexical items. For instance, enregistered terms of address include *b*, *boy* [bɔi] in New York; *ack* [ɑk] in New York and Philadelphia (originally to refer to Muslims, from *Ahmed*); *moe* in Washington D.C. and Baltimore (Annon, 2016); *joe* in Chicago; and *shawty* and *boy* [bw͡ɑɪ] in Atlanta.

Lastly, while it's taken as axiomatic that the morphosyntax does not vary significantly, recent work I performed with speakers from North Philadelphia and in Harlem (Jones et al., 2019) resulted in very different responses about familiarity with and understanding of *be done* constructions (e.g., *I be done gone to bed when he be gettin' off work*, (see Labov 1972a and Green 2002 for fuller treatment), suggesting the possibility of change in apparent time among Philly AAE speakers.

The above is just a sample of the literature on variation in AAE, but it should already be clear that there is significant variation from place to place. However, the researcher interested in regional variation is left with a long list of facts about individual sounds in individual places, and no clear picture of the overall pattern of AAE in North America, or why it should be that there is an apparent tension between participation in and change away from local white varieties. Some recent research has examined regional variation (for instance, Wolfram and Kohn 2015 on regional variation in North Carolina, Lee 2016 on variation between neighborhoods in Washington DC, and Wroblewski et al. 2009 on regional variation in rural Louisiana), but they focus on individual sociolinguistic variables (e.g., fronting of /uw/, deletion of postvocalic /r/) on a state or city level. This dissertation aims to address this situation by providing a national level description of variation in AAE.

2.4.1 The Role of the Great Migration

At the end of the 19th century, the vast majority of African Americans lived in the South. Starting at the beginning of the 20th century, and continuing until the beginning of the 1970s, there was a mass exodus of African Americans from the South, generally to Northern cities, which occured in two waves, and is generally referred to as the Great Migration (Wilkerson, 2010). Historically, some claimed that the migration was precipitated by a desire for better opportunities in industrial work, however it is now increasingly clear that a considerable component was flight from racial terror lynchings and other forms of racial terrorism in the Jim Crow South (Equal Justice Initiative, 2017).

In 1910, Chicago's population was only 2% black, however by 1970 it was almost 33% black (Equal Justice Initiative, 2017). Similarly, St. Louis went from 6.4% to 40.9%, Detroit went from 1.2% to 43.7%, Cleveland went from 1.5% to 38.3%, and New York City went from 1.9% to 21.1% black (Equal Justice Initiative, 2017). Moreover, the migration traveled along specific routes, generally following rail lines and, later, the interstate highway system. So, for instance, those fleeing Mississippi did not go just anywhere, but rather fled northward up the Mississippi River Basin, with the vast majority ending up in Chicago (Wilkerson, 2010). These paths are not perfectly charted, but a rough approximation is presented in figure 5.21, following Jones (2015b).[13] When new in-migrants arrived in the North, they

[13] After Smallwood and Elliot (1998).

were met with residential, educational, and social segregation. While "separate but equal" was struck down in 1952, the Civil Rights Act passed in 1964, and the Fair Housing Act passed in 1974 (thereby banning the practice of redlining), the effects of *de jure* segregation persist in ongoing *de facto* segregation. Chicago, for example, had a dissimilarity index in 2010 of 76 out of a maximum of 100, indicating strong racial segregation (zero corresponds to total integration, 100 corresponds to complete segregation).

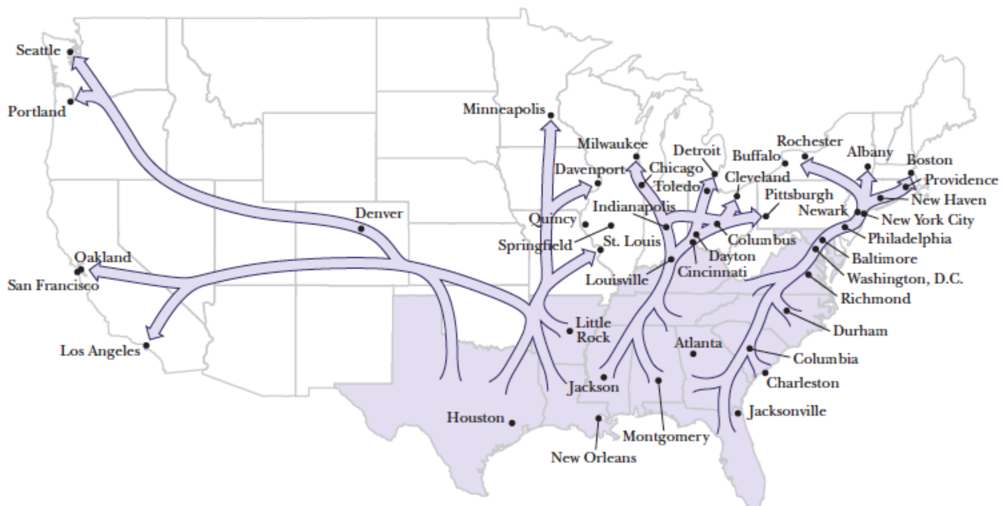


Figure 2.3: Paths of the (second) Great Migration (Jones, 2015b)

This tremendous migration is likely part of why AAE has historically been considered to be largely homogeneous: when the seminal studies of AAE were being performed, the Great Migration was still ongoing. No doubt AAE speakers in Detroit, Philadelphia, and New York sounded like those in the South; many still had immediate connections to the South, and little or no contact with local whites. Given that there is scattered evidence for regional variation in AAE, it may be reasonable to expect that such variation is not solely the result of linguistic drift subsequent to the migration, and neither is it accommodation to local white norms (to which speakers were likely not significantly exposed during childhood language acquisition), but rather, regional variation in AAE might pattern geographically with population movements during the Great Migration, and subsequent linguistic evolution. This supposition will be shown to be the case in chapters 4 and 5 of this dissertation.

2.4.2 New Methods

This dissertation makes a number of important methodological contributions. In chapter 3, I apply contemporary geostatistical methods – kriging and Getis-Ord Gi* – to data from the *Atlas of North American English* (Labov et al., 2005).[14] The findings largely corroborate those of the ANAE, but add a degree of nuance to our understanding of the propagation of linguistic change, and do so in a mathematically sound manner that insulates the findings from undue influence from the researcher's a priori assumptions or subjective decision-making. The Getis-Ord Gi* makes geographic hot and cold clusters more apparent than in the raw data (where here, "hot" may correspond to, say, a cluster of significantly higher F2 values in Hz). Kriging is the best unbiased linear estimator of intermediate values, and this remains the case regardless of point sample locations.[15] Rather than inspecting point data visually and drawing isogloss boundaries manually, these methods allow geographic boundaries in the data to emerge without significant researcher intervention or explicit direction.

In chapter 4, I apply the same methods to a new corpus of AAE speech, comprising 181 speakers across the country, reading a new reading passage specifically designed to elicit naturalistic AAE. Because Kriging is the best unbiased linear estimator of intervening values, and because it is agnostic about point sample locations, the maps produced in chapter 4 are reasonably comparable to those from the Atlas of North American English

[14] Generally pronounced [d͡ʒi a͡ɪ stɑɹ].

[15] Note that each of these has a specific, technical meaning in statistics: kriging is *unbiased* in that it does not systematically under- or over-estimate the population parameter, and it is the *best* unbiased linear estimate because it is the estimate that minimizes variance.

in chapter 3, despite different sample locations. In chapter 4, I introduce a new reading passage, *Junebug Goes to the Barber*, and a new method of dialect data collection (large-scale social-media-based participation). In chapter 4, I also present a new method of evaluating monophthongization of /ay/, using dimension reduction performed on a 12-dimensional sample of Mel Frequency Cepstral Coefficients (MFCCs). Traditional methods of investigating mergers – in this case, the Pillai score, a variant of ANOVA – are also employed, and for the first time in a sociolinguistic investigation of AAE, they are mapped.

In chapter 5, I make use of unsupervised machine learning techniques to investigate regional patterns and linguistic phylogenetic patterns; specifically, k-means clustering and agglomerative hierarchical clustering analysis. I find, in chapters 4 and 5, that there is strong evidence for regional variation in AAE that patterns with population movements during the Great Migration.

While some of these methods have been applied before in dialectology, like kriging (Grieve, 2011; Grieve et al., 2011), some in sociolinguistics, like the Pillai statistic (Nycz and Hall-Lew, 2013), and some in historical linguistics, like, agglomerative hierarchical clustering (Hastie et al., 2009), others of these methods (the analysis of monophthongization in chapter 4) and combinations of methods (the combination of sociolinguistic approaches to merger with geostatistics) are entirely novel, and represent a methodological advancement in linguistics, however incremental.

In the next chapter, I turn my attention to the application of new methods to data from the *Atlas of North American English*.

Chapter 3

The Atlas of North American English

3.1 Introducing the Atlas

This chapter investigates the patterns of regional variation present in the data from the *Atlas of North American English* (Labov et al., 2005). As the largest, most comprehensive study of regional variation in North American English to date, the *Atlas* is the established baseline against which any study of regional variation will necessarily be compared.

The *Atlas of North American English* is the "gold standard" (Doyle, 2014) for dialect geography in North America, and as such is the main point of comparison for this dissertation — one of the two starting points against which empirical observations are compared in the next chapter.[1] The *Atlas* (henceforth, the ANAE) is the fruit of a massive study executed over the course of 7 years, comprising 805 sociolinguistic interviews with people from across the continental United States and Canada. The primary research method was a the Telephone Survey conducted between 1992 and 1999, and analyzed for the six years following. The 805 interviews yielded 762 data points, of which 439 were used for acoustic analysis, representing samples taken at 145 locations in the United States.

The primary goal of the ANAE was to answer three questions:

1. How many dialects of North American English are there?

2. What phonological features define them?

3. What are their boundaries?

Sampling was based on population, and Labov, Ash, and Boberg used a number of criteria to decide where to sample, focusing on Zones of Influence (ZI), Central Cities, and Urbanized Areas (UA). The Urbanized Areas comprised 356 speakers in the continental United States, from 145 locations, broadly construed.[2]

[1] The other being the naive null hypothesis that there is no consistent regional variation in African American Language.

[2] e.g., New York City, or Denver, Colorado.

It is important to note that the ANAE was never meant to be representative of all the dialect variation in North America. The ANAE sample was, by design, urban, local, white, and not college educated. As the authors explain:

> "A list was made of all the census tract numbers which satisfied the criterion of 10 percent or less foreign born white persons. From that list, those who did not satisfy that two thirds of the population should be white...were eliminated. [...] those [census tracts meeting the above requirements] in which the rate [of holding a bachelor's degree or higher] was greater than about 20 percent were eliminated."

As such, treating the ANAE as a baseline against which to compare regional variation in AAE is not entirely unproblematic. Given the existing literature on both dialect regions in North America and on variation in AAE, there are two possible neutral theoretical positions we may start from, which will be excluded in later chapters:

1 : There is no significant regional variation in African American English; that is, it is more-or-less homogenous.

2 : There is regional variation in AAE, and that regional variation patterns with the regional variation in (white) North American English already well described in resources like the ANAE.

These positions and the converse — that there is regional variation in AAE and it patterns significantly differently from existing descriptions of (white) regional variation — will be discussed in subsequent chapters. However, in introducing the ANAE, it is important to discuss the ethno-racial implications and limitations of using it as a baseline against which to compare AAE variation at the outset. Specifically, the ANAE is white normative, and divergence in a sample of African American speech from what is described in the ANAE

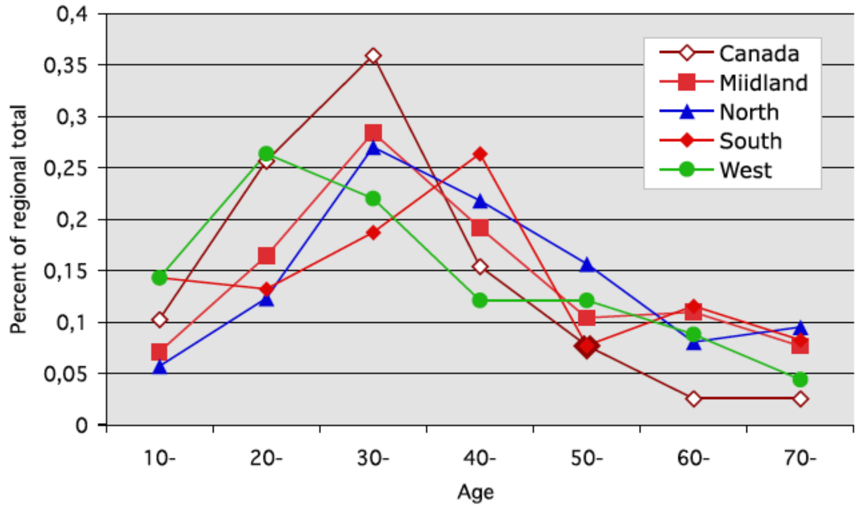


Figure 3.1: Ages in the ANAE Telephone Survey

is not divergence from a baseline of American English, but is rather divergence from (or a lack of convergence toward) white ethnolinguistic norms, themselves more or less divergent from the abstract neutral English starting point discussed in the ANAE.

Moving away from the intentional racial and socioeconomic sampling bias for the moment, it should also be noted that there were a number of other intentional sampling biases in the ANAE data, based on *a priori* assumptions, justified elsewhere in the literature, that young speakers are more advanced in terms of language change, and women are the leaders of linguistic change (Labov, 1994). As will be discussed in the next chapter, the participants in my sample mirrored this sampling bias, skewing young and female.

3.2 Analysis in the Atlas

The analysis performed for the ANAE was performed on speaker-normalized pseudo-formant[3] values, plotted as points on a map of North America. The points were color coded,

[3]That is, the speakers' data were transformed through a variant of Neary log-normalization used in the ANAE, now commonly referred to as Labov normalization.

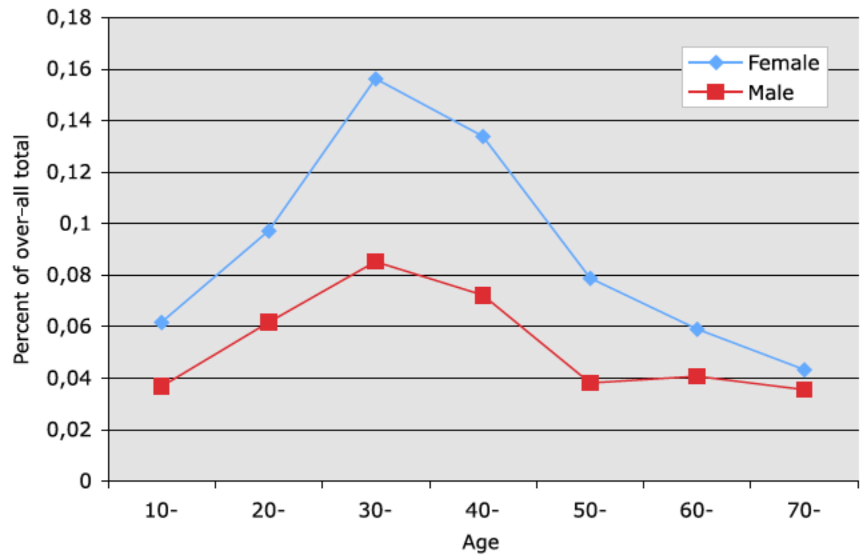


Figure 3.2: Sexes in the ANAE Telephone Survey

based on theoretically motivated breaks. That is, the breaks were not decided through analysis of the distribution of formant values, but rather by analyst decision about what inherently constitutes say, front, central, and back vowels, or high, mid, and low vowels. for instance, the analysis of /æ/ (as in TRAP) tensing in the Inland North relies on an isogloss drawn around points for which the (speaker normalized pseudo-) F1 of /æ/ is less than 700 Hz (Labov et al., 2005, pp. 121).

As Labov et al. (2005) lament:

> "Every dialect geographer yearns for an automatic method for drawing dialect boundaries which would insulate this procedure from the preconceived notions of the analyst. No satisfactory program has yet been written."

Based on that assumption, the primary method of analysis was the construction of isoglosses, effectively by hand. The isoglosses in the ANAE were constructed using an iterative algorithm. The authors of the *Atlas*:

1. visually identified clusters,

2. constructed a minimally enclosing polygon,
3. iteratively expanded the polygon subject to (point) class constraints,
4. repeated this process until they could not any more, and
5. smoothed the polygons by hand.

These will be discussed in turn below.

To identify clusters of points, first, points were assigned color values based on the breaks posited by the authors. These points were plotted on a map of North America. The authors of the ANAE then visually inspected the map, and drew a polygon around a pattern of point values they determined constituted a cluster. The polygon was drawn to have as few vertices as possible. They then expanded these polygons, subject to a number of constraints designed to keep data of different classes (here, point colors) as separate as possible while capturing as much of the regional pattern of an individual class as possible. In practice, this meant expanding the polygon to include a new (color-matched) point only insofar as it was possible to do so by adding one (and only one) vertex to the polygon and when doing so would result in a maximum of one *non*-matching point's inclusion in the new polygon. A visual aid is included in figure 3.3 (Labov et al., 2005, pp. 41-44).

In the figure, the original polygon is in blue, enclosing a cluster of blue dots. Green segments represent possible expansions of the original polygon, which now can include points b, c, and d. Red segments represent rejected expansions, which would include points e and f, but which require more than one additional vertex. Simiarly, point i could be included with one additional vertex, but such a change would also include more than one yellow point.

This process was repeated until the polygons were stable. Then, the polygons edge paths were smoothed using Bézier splines in GIMP (an open source image editing software).

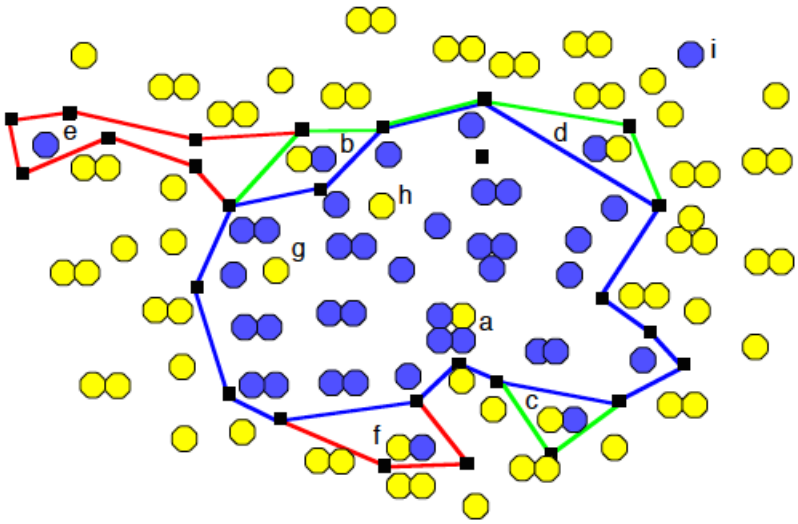


Figure 3.3: Isogloss polygons in the ANAE

Figure 3.4: Dialect Regions in the ANAE

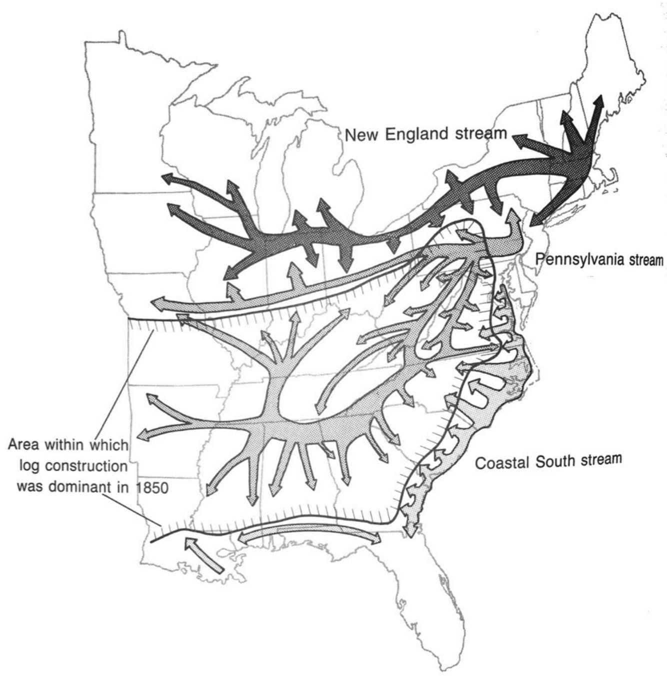


Figure 3.5: Housing construction materials following cultural patterns of westward expansion, after Zelinsky (1973)

The high level summary of their findings is represented in figure 3.4.

Of particular interest for the present dissertation is that dialect regions appear to spread like fingers westward away from the East Coast, in horizontal bands across the United States, with a broad, undifferentiated West. The dialect regions in the ANAE can be seen, especially in the eastern half of the country, as a sort of latitude "layer cake." These "horizontal" layers correspond to broad patterns in the westward migration of white people in the history United States, and still correlate well with a number of cultural distinctions, including housing styles and materials.

The process described above for drawing isoglosses resulted in one of the clearest pictures to date of regional variation in North American English. However, despite the enormous value of the ANAE's contribution it has a number of methodological drawbacks. First, a change in cutoff between point classes can potentially dramatically affect dialect boundaries, without any change in the empirically observed data. Second, it creates an illusion of uniformity within a dialect region that may not be justified by the data. Third, it is dependent on the researchers' visual inspection, and may obscure subtle relationships in the data that would change the final analysis or point toward further research topics.

3.2.1 What Makes a Dialect Region?

In the Atlas of North American English, the authors propose six criteria for what constitutes a dialect region. They argue that not all aspects of a local vowel system should necessarily be included in the decision about where dialect region boundaries fall. Citing *Garde's Principle*, that mergers are irreversible by linguist means, and *Herzog's Corollary*, that mergers expand (geographically) at the expense of distinctions (Labov 1994, pp. 311, cited in Labov et al. 2005), they argue against using mergers in the evaluation of dialect regions, stating "isoglosses created by ongoing mergers will not be used to define the major regional dialects,[4] since they are driven by Herzogs principle to expand across previously established frontiers." (Labov et al., 2005, pp. 57) Their six criteria (Labov et al., 2005, pp. 120) are that a dialect region should be:

1. *Consistent.* In order to qualify as a dialect region, the area should be geographically continuous.

2. *Exclusive.* No speech communities outside of the region should have the features in questions.

3. *High frequency.* The variables under discussion should occur frequently. The main reason for this claim in the ANAE seems to be that a variable should be frequent enough that analyses are replicable.

[4]Interestingly, though, mergers are commonly used in description of ethnolects, so one of the commonly discussed features of African American English is the supposed universality of the PIN-PEN merger.

4. *Qualitative.* By "qualitative," the authors make it clear they mean that the existence or analysis of the variables in question should not depend on "particular methods of measurement or normalization" (Labov et al., 2005, pp. 120). I take this to mean that they should be noticeable to listeners (e.g., the PIN-PEN merger), in addition to being quantifiable.

5. *Convex in distribution.* The geographic spread should be convex, "indicating the feature is expanding from an originating center or still preserves evidence of such earlier expansion." (Labov et al., 2005, pp. 120)

6. *Systemic.* By this, the authors mean that a proposed dialect region should reflect "relations among two or more elements of the phonological system" (Labov et al., 2005, pp. 120).

Based on the above, we would not say, for instance, that the expansion of the COT-CAUGHT merger constitutes an expanding dialect region. The authors of the atlas are particularly interested in the low vowels as triggers of chain shifts that resulted in distinct dialect regions in European American English, arguing "the existence of splits or mergers in the low vowels has a profound effect upon the economy of the system and will play a major role in the definition of dialect regions." They go on to argue that "Many of the mergers [mapped in the Atlas] are conditioned mergers, confined to allophones before nasals or liquids, and do not directly affect the system as a whole. By contrast, the unconditioned merger of the low back vowels [...] does have an important effect on the vowel system as a whole, and the status of this merger will be one of two pivotal criteria in establishing a typology of North American vowel systems. The other pivotal factor is the status of the historical short-a class, which follows many radically different forms throughout the continent. The two pivot conditions have to do with the status of the low vowels" (Labov et al., 2005, pp. 120). They go on to state it even more succintly: "The dynamics of a

Region / Dialect	Defined by
North	Conservative /ow/, no low back merger
Inland North	Northern Cities Shift
St. Louis Corridor	Northern Cities Shift
Western New England	Less advanced Northern Cities Shift
Eastern New England	Vocalization of /r/, short-*a* nasal system
Boston	Fronting of /ah/ distinct from /o/, low back merger
Providence	Conservative /uw/ and /ow/, no low back merger
New York City	Vocalization of /r/, split of short-*a*
Mid-Atlantic	No vocalization of /r/, split of short-*a*
Western Pennsylvania	Low back merger
Pittsburgh	Glide deletion of /aw/
South	Glide deletion of /ay/
Inland South	Southern Shift
Texas South	Southern Shift
Charleston	(Monophthongal /e:/ and /o:/; r-lessness)
Midland	Transitional low back merger, fronting of /ow/
Cincinnati	(short-*a* system like NYC)
St. Louis	(/ah/ and /oh/ merged)
Southeast	Fronting of /uw/, /ow/,
West	Low back merger, fronting of /uw/ but not /ow/, no Canadain Raising
North Central	Low back merger, conservative /uw,ow/, no Canadian Shift or raising
Canada	Low back merger, fronting of /uw/ but not /ow/
Canada	Canadian Shift and Canadian raising of /aw/
Atlantic Provinces	Canadian raising, fronting of /ahr/

Figure 3.6: ANAE Regions and Dialects

North American vowel system ... depend upon whether (a) the low back merger has taken place and (b) whether the short-a split has taken place." As will be demonstrated in the next chapter, regional variation in African American English is also tied to movement in the low vowels, albeit different patterns of change.

Labov et al argue for 11 dialect regions encompassing 13 sub-dialects (figure 3.6). I will briefly discuss the two most prominent – the Northern Cities Vowel Shift, and the Southern Vowel Shift – below. My use of Gi* hot-spot analysis below will focus on these two regions, as well.

Northern Cities Vowel Shift

The Northern Cities Vowel Shift is defined by a series of vowel movements, primarily among the lax vowels. It is defined by:

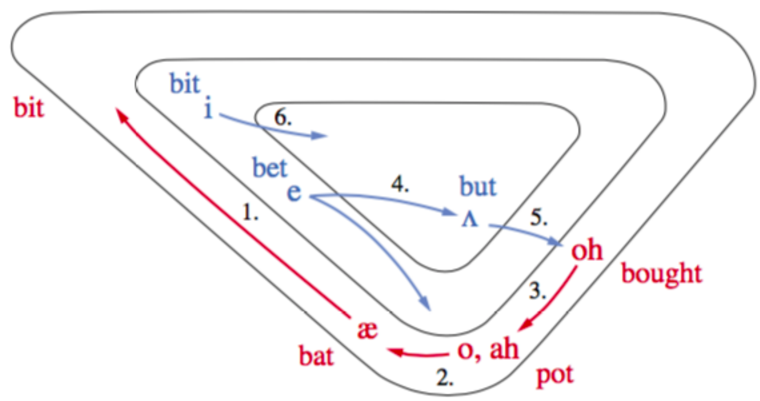


Figure 3.7: The Northern Cities Shift after Labov (2005)

1. tensing and raising of /æ/ as in TRAP (toward /iy/).

2. fronting of /o/ as in COT (to /ae/).

3. lowering (and fronting) of /oh/ as in CAUGHT (to /o/)

4. lowering and fronting of /ʌ/ as in STRUT (to /oh/).

5. backing or backing and lowering of /e/ as in DRESS (to /ʌ/ or /o/, as in Labov's example of "budgeroom" (Labov, 1994)).

6. the lowering and backing of /i/ as in KIT.

Another result of this shift is that /ʌ/ is backer than /o/.

The generally accepted explanation is that the tensing and raising of /æ/ was the triggering event, and that the rest of the shifts above occurred in response to this initial triggering event (Ito, 1999; Ito and Preston, 1998; Labov, 1972b, 1991; Thomas, 2002, 2006; Veatch, 1991). The tensing of /æ/ alone is not sufficient grounds for claiming a dialect region, but the geographic spread of that shift and the subsequent shifts it triggered, when considered together, are among the strongest candidates for consideration as a regional dialect.

Many scholars have noted that African American communities in northern cities seem not to participate in the NCVS (see Labov and Fisher, 2015; Van Herk, 2008, inter alia). This will be corroborated, and elaborated upon, in the next chapter.

Southern Vowel Shift

The Southern Vowel Shift is similarly defined by a triggering event. In this case, the monophthongization of /ay/, rather than the tensing and raising of /æ/, resulting in a different chain shift. The SVS is defined by:

1. the (unconditional) monophthongization of /ay/ as in PRICE.
2. the lowering of /ey/ as in FACE (to /ay/).
3. the lowering of /iy/ as in FLEECE (to /ey/).
4. the raising and tensing of /æ/ as in TRAP (toward /ey/).
5. the raising and tensing of the nucleus of /e/ as in DRESS (toward /iy/, with splitting of the vowel)/.
6. the raising and tensing of /i/ as in KIT (toward /iy/, also with splitting).

Elements of the SVS are known to be present in (some varieties of) African American English, albeit not at the same rates as in coterminous European American English. For instance, monophthongization of /ay/ is a salient feature of AAE, especially in the North, where it is generally not present in the speech of European Americans, however, /ay/ is not unconditionally monophthongized in AAE (Fridland, 2003; Thomas, 2007). The change in offglide from /iy/ to /ih/ and splitting of /i/ leading to the apparent reversal of /iy/ and /i/ – and the same process with /ey/ and /e/ – have been claimed to be characteristic of the

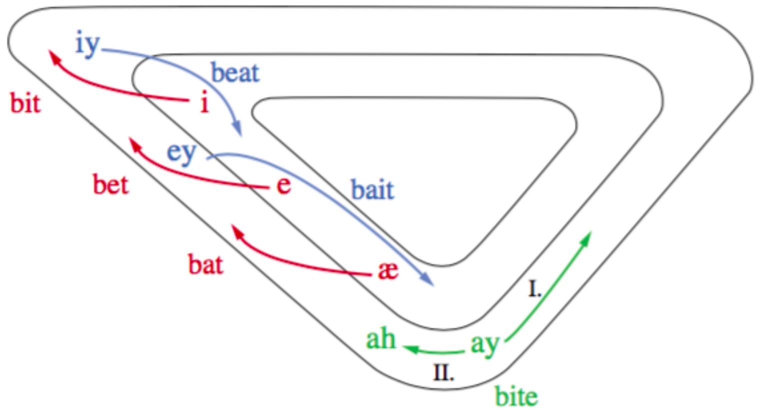


Figure 3.8: The Southern Vowel Shift after Labov (2005)

proposed African American Vowel Shift (King, 2016; Kohn and Farrington, 2013; Thomas, 2007; Yaeger-Dror and Thomas, 2010).

The South is actually defined by a second chain shift, as well (Labov et al., 2005, pp. 127):

1. splitting of /oh/ as in OUGHT and fronting of the nucleus, to /aw/ (as in OUT).

2. fronting and raising of the nucleus of /aw/ as in OUT (to /æw/).

In the next chapter, it will be demonstrated that this second shift is prevalent in AAE, in a geographic region that overlaps somewhat with that in the ANAE, but also diverges from it significantly.

3.3 A New Analysis of ANAE Data

For this dissertation, I analyzed the data used to construct the ANAE following different methods drawn from geostatistics. Specifically, following Grieve et al. (2011), I investigated dialect regions using the Getis-Ord Gi* statistic (Getis and Ord, 2010) and using kriging (Matheron, 1965). The Getis-Ord Gi* statistic identifies statistically significant clusters of high or low values. kriging is the best linear estimator for interpolated values between samples taken at point locations which represent a continuous variable. Originally intended for mining applications, kriging has a variety of geostatistical applications, including interpolating temperature estimates for weather maps.

Statistically, individual formant measurements for a given vowel from speakers at multiple individual locations can be thought of as conceptually equivalent to ore or temperature measurements: all represent a continuous variable (F1 in Hz for speakers' pronunciation of the KIT vowel, quantity of ore per drilling sample, temperature in degrees Fahrenheit at a given measuring station). This means that rather than drawing isoglosses by hand after the researcher divides measurements into a small number of classes, it is possible to use a consistently reproducible statistical transformation to create a dialect 'heatmap' representing regional variation for a given variable (or combination of variables, as will be seen below).

3.3.1 Methods

This analysis used the data from the same 346 speakers from 145 urbanized areas in the TelSur as were used for the orignal ANAE analysis. Analysis was performed in R using `gstat`, `sp`, `spdep`, `maptools`, `autokrige`, `tiger` and the `tidyverse` suite of packages. Speakers' exact locations were not known, however, the TelSur includes city and county data for speakers, so they were assigned longitude and latitude point locations corresponding to the centroid of their county or city. Multiple speakers were assigned the same location, and the points were then slightly jittered. This means that the data is only truly granular at the county level, with some minor error, however the point accuracy is slightly greater than that of the final maps for the ANAE (compare against figure 3.4 above, where the points are relatively large, and grouped based on map readability and not exact location). The distances used to calculate the empirical variograms (next section) were *great circle distance* (figure 3.9). The projection used was the *equidistant conic* projection (see

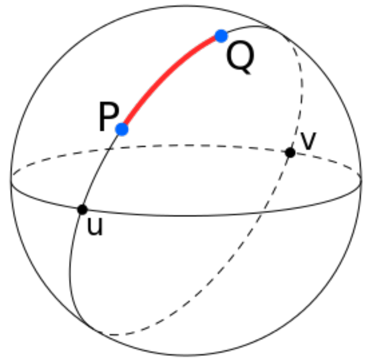


Figure 3.9: Great Circle distances

Figure 3.10: Equidistant Conic projection

figure 3.10.). Interpolation was continuous (rather than assigned as set number of breaks, cf. Grieve 2013).

I performed three types of analysis. The first was the construction of interpolations for individual vowel formants (e.g., the first formant for all speakers' /e/). The second was an analysis of regional variation that allowed dialect regions to emerge from the data rather than superimposed isoglosses, which was achieved through Principal Components Analysis (PCA) of the formant values that were sufficiently uncorrelated and which exhibited sufficient spatial variation. The third was to use the Getis-Ord Gi* statistic rather than the untransformed formant data, and to repeat the previous two steps (that is, to interpolate Gi* values, and to interpolate values for the first n significant principal components).

3.3.2 Kriging Alone

The first analysis takes as a starting point the vowel classes selected by Labov et al. (2005) as relevant to the study of regional variation. All vowels exhibited sufficient normality, allowing me to perform ordinary kriging, and then map the results. The results presented here will focus on the Northern Cities Vowel Shift and the Southern Vowel Shift, as discussed above.

Kriging (alternately known, less commonly, as Gaussian process regression) is a method originally used in mining that takes a sample of continuous measurements at discrete points, and provides the best unbiased linear estimate of values at all intervening locations.[5] That is, kriging takes sample points and returns a field of estimates. The most familiar application of kriging for laymen is the weather radar used in daily forecasts: continuous environmental variables (temperature, barometric pressure, humidity, precipitation) are measured at discrete locations, and estimates are interpolated to provide, say, map of daily high temperatures.

Put simply, kriging estimates are similar to performing Ordinary Least Squares regression (OLS), but with the added caveat that it takes into account spatial covariance among sampled points at all distances.

Whereas OLS takes the form:

$$Y(s) = \mu(s) + \epsilon(s), s \in R \tag{3.1}$$

Kriging takes the form:

$$Y(s) = \mu(s) + U(s) \tag{3.2}$$

[5]Recall that *unbiased* means it does not systematically over- or under-estimate parameter values, and *best* means that it is the unbiased estimate with the least variance.

where

$$U(s) = u(s) + \epsilon(s) \tag{3.3}$$

Another way of looking at this is the linear algebra, which makes the intuition behind the procedure a little clearer. Generalized Least Squares – of which ordinary Kriging is a subset – has the same structure as OLS, with the exception that it includes the inverse covariance matrix for sample points.

That is, while OLS takes the form:

$$\hat{\boldsymbol{\beta}} = (\boldsymbol{X}^T\boldsymbol{X})^{-1}\boldsymbol{X}^T\boldsymbol{y} \tag{3.4}$$

$$VAR(\hat{\boldsymbol{\beta}}) = \sigma^2(\boldsymbol{X}^T\boldsymbol{X})^{-1} \tag{3.5}$$

Generalized Least Squares takes the form:

$$\hat{\boldsymbol{\beta}} = (\boldsymbol{X}^T\boldsymbol{C}^{-1}\boldsymbol{X})^{-1}\boldsymbol{X}^T\boldsymbol{C}^{-1}\boldsymbol{y} \tag{3.6}$$

$$VAR(\hat{\boldsymbol{\beta}}) = \sigma^2(\boldsymbol{X}^T\boldsymbol{C}^{-1}\boldsymbol{X})^{-1} \tag{3.7}$$

In principle, we don't actually know the underlying process we are trying to model, so we don't know the covariance matrix. We estimate the covariance matrix using the empirical variogram.[6]

One way of interpreting the results is to view the transition areas as indicative of potential isogloss locations. That is, if we map on a color scale from blue through white to red, the white bands are the transition areas between more divergent values, and can be thought of as representing borders between two classes. Given that each of the vowel classes investigated fall on a two dimensional parameter (ie., front-back, high-low), this way of looking at things

[6] An excellent explanation of this procedure can be found in (Bailey and Gatrell, 1995)

makes intuitive sense: if there is significant regional variation, it will be a binary distinction, with some regions pronouncing a given vowel fronter (or higher) than other regions. We therefore expect a bimodal distribution conditioned on location, with intermediate values demarcating regional boundaries.

Here, however, the focus is on intensity of a pattern rather than determining exact boundaries, which may not necessarily be the best way to think about regional variation anyway (Chambers and Trudgill, 1998; Grieve, 2018). For readability, the colorscale used here is the colorblind-friendly *viridis* colorscale. In the sections below, examining the Northern Cities Vowel Shift and the Southern Vowel Shift, the direction of the color scale has been manipulated so as to keep the vowel movement implicated in the vowel shift in warm colors – that is, rather than mapping warmer colors to higher numbers, warm colors are mapped to greater participation in a vowel shift. For vowel fronting or lowering, this will correspond to higher numbers in Hz, however for backing and raising, the color scale will be reversed.

It should also be born in mind that kriging interpolates values for all intermediate locations, so the kriged estimates should be taken with a grain of salt. Because the underlying process is seldom uniformly present, estimated values should be evaluated with the underlying population in mind, where known. For this reason, it may also be better to compare against point maps of the Gi* transformed data, which make hot and cold clusters more visible but do not posit values in places that were not sampled (section 3.3.4, below).

NCVS Kriging results

Using kriging alone, for each of the vowels that contributes to the Northern Cities Vowel Shift and to the Southern Shift, regional patterns become immediately apparent. However, another facet of the NCVS becomes apparent in the kriged data, that was not visible from the point data alone: different vocalic patterns are more intense in different cities.

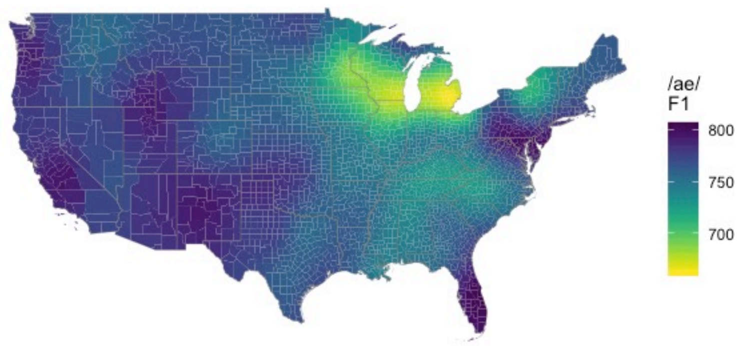


Figure 3.11: F1 of /æ/ in the ANAE

Starting with the raising of /æ/, it is clear that Chicago, Milwaukee, and Detroit are the most advanced, with Minneapolis following, and Rochester, Buffalo, and Syracuse less advanced, but still participating in this shift (figure 3.11).

Similarly, /ae/ is frontest in Chicago and Milwaukee, with the other cities following with less intensity (figure 3.12).

/o/ (as in COT) is fronted with the most intensity in Chicago and Milwaukee, but contrary to the pattern for /æ/, Syracuse and Detroit are the next most intense (figure 3.13).

/oh/ as in CAUGHT is the next vowel in the shift. Here, we see Minneapolis leading (figure 3.14).

Wedge (as in STRUT) is backed the most in Detroit and Syracuse, with Chicago, Milwaukee, and Minneapolis following (figure 3.15).

Buffalo (and parts of western Pennsylvania) lead the lowering of wedge (figure 3.16).

Similarly, Buffalo and Rochester lead the lowering of /e/ as in DRESS (figure 3.17).

Detroit and Chicago lead the backing of /e/ (figure 3.18).

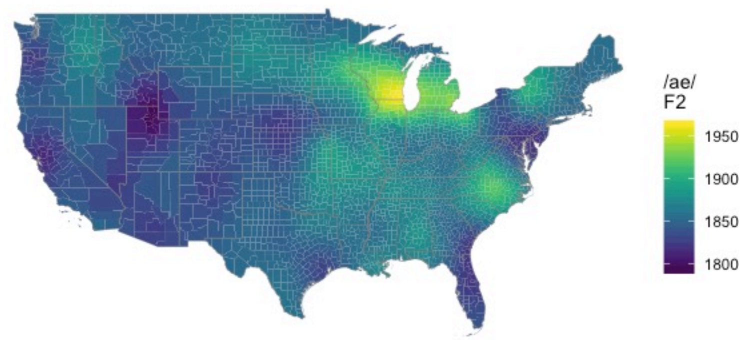


Figure 3.12: F2 of /æ/ in the ANAE

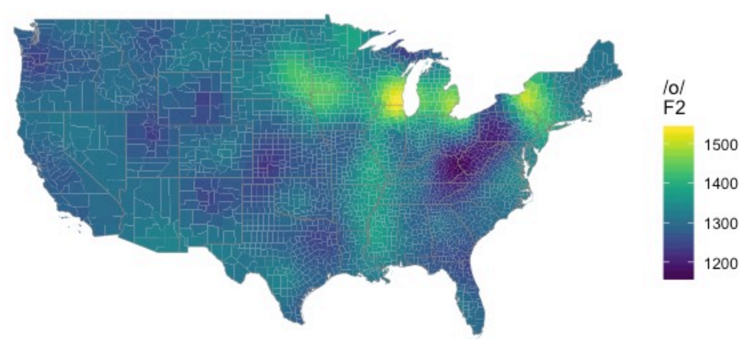


Figure 3.13: F2 of /o/ in the ANAE

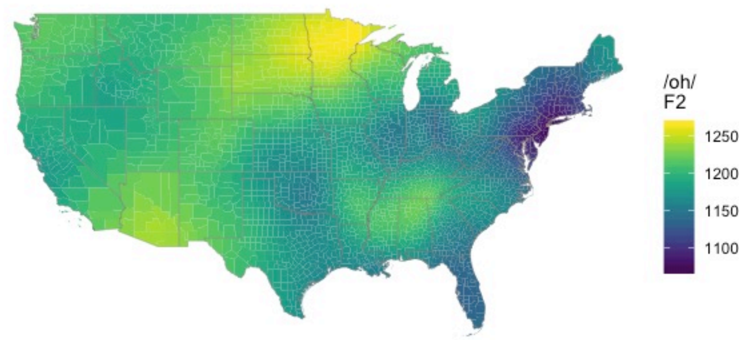


Figure 3.14: F2 of /oh/ in the ANAE

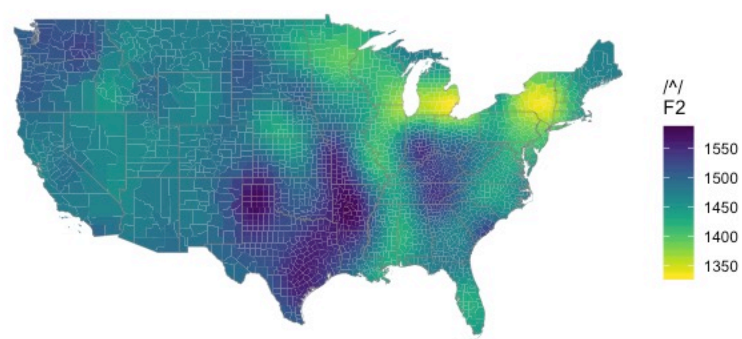


Figure 3.15: F2 of /ʌ/ in the ANAE

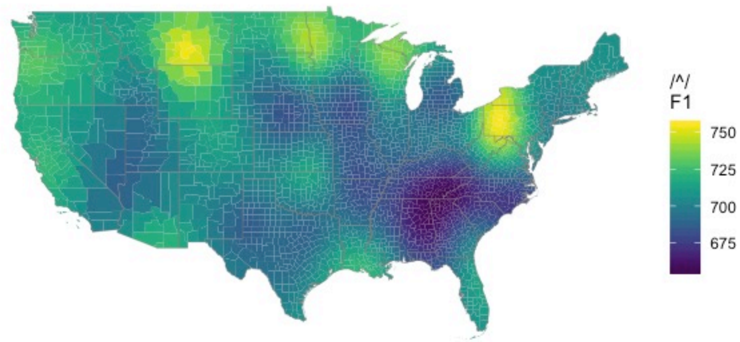


Figure 3.16: F1 of /ʌ/ in the ANAE

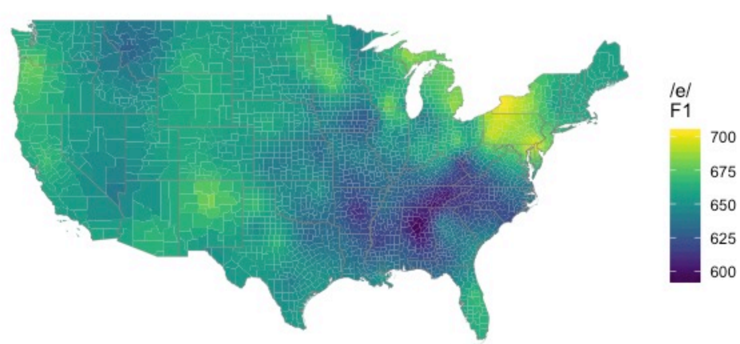


Figure 3.17: F1 of /e/ in the ANAE

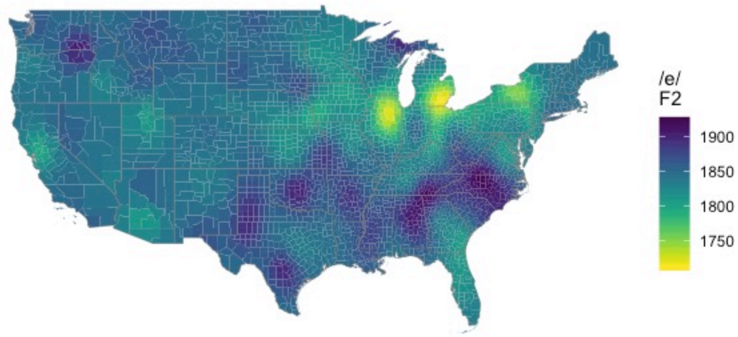


Figure 3.18: F2 of /e/ in the ANAE

The lowering of /i/ is also apparent in the Northern Cities, however separate patterns in the Northeast and in California obscure it here (figure 3.19).

The backing of /i/, however, is strongly noticeable from Detroit to Chicago, with the other northern cities following with less intensity (figure 3.20).

Superimposing the maps, the NCVS is immediately apparent, with strong hotspots around the cities implicated in the shift (figure 3.21).

NCVS Kriging discussion

The above confirms that the NCVS emerges from the data alone, and provides strong evidence in support of the dialect region mapped in the ANAE. However, it also problematizes the standard view that the NCVS is one chain shift started by a single triggering event and spreading from a single location. Rather, it seems to be a constellation of changes moving at different speeds in different places.

Previous discussion of the NCVS takes as standard the assumption that there is one

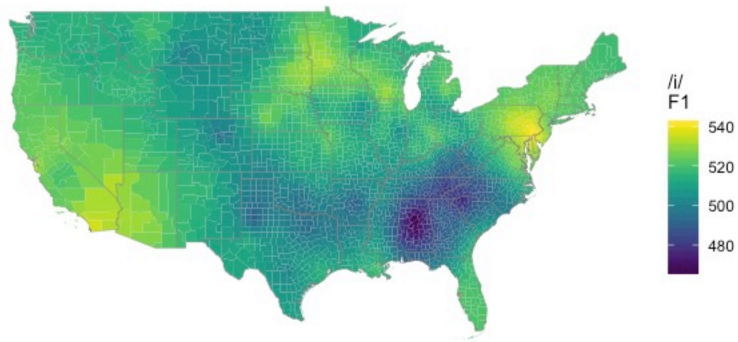


Figure 3.19: F1 of /i/ in the ANAE

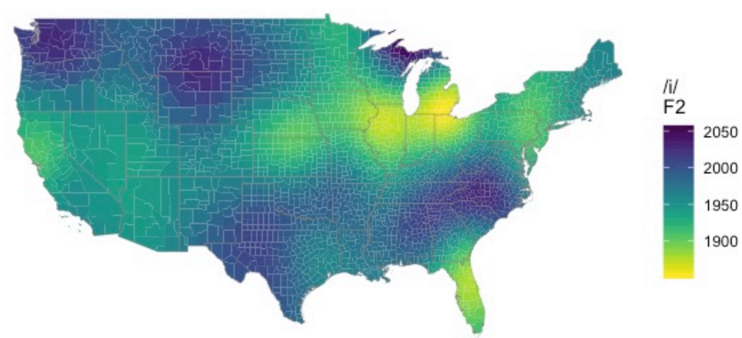


Figure 3.20: F2 of /i/ in the ANAE

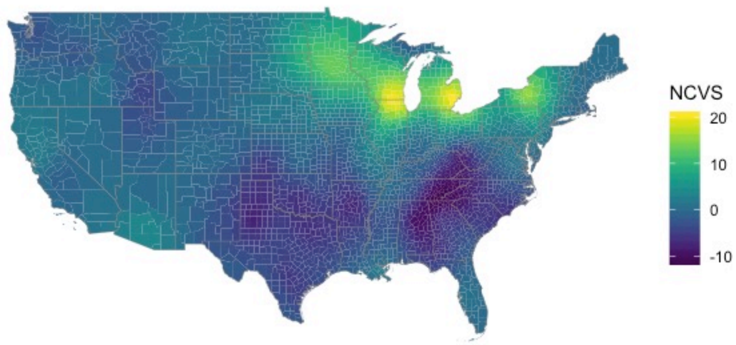


Figure 3.21: The Northern Cities Vowel Shift ANAE

factor that functions as a trigger for the chain shift. In this view, a key focus of inquiry becomes the question "where (and when) did the chain shift start?" That is, we assume an individual feature is the first feature, and that changes spread outward from an initial location, albeit perhaps following a gravity or cascade of diffusion in which urban centers experience changes first and those changes then trickle down to surrounding non-urban communities (Trudgill et al., 1974). A representative example of this view can be found in (Gordon, 2002). Wave and Gravity models are discussed in Chapter 2.

However, the results from kriging the ANAE data suggest that different components of the Northern Cities Vowel Shift are more advanced in different places, casting into doubt the normal questions we might ask of a "chain shift". Whether it is a push-chain or a pull-chain, which element was the trigger – these are less meaningful when we see that various aspects of the shift are advancing more independently of one other than may have previously been assumed. This is discussed further below, in section 5.4.

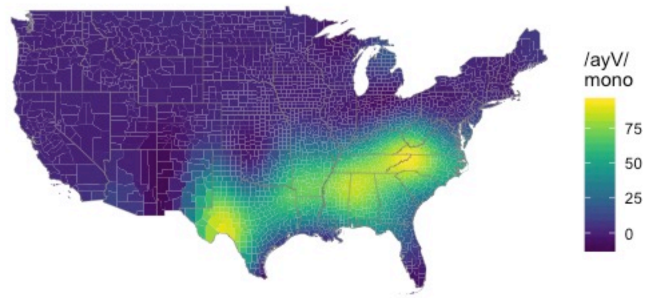


Figure 3.22: /ay/ monophthongization not before voiceless consonants

SVS Kriging results

Similar to the NCVS, the Southern Vowel Shift does not seem to be centered on one location and spreading outward, when we disagregate the data – however, it is much more consistent with wave and cascade models of diffusion than the NCVS.

Traditionally, the SVS is taken to start with the unconditional monophthongization of /ay/ as a trigger. Monophthongization of /ay/ to /ah/ before a vowel or pause is widespread across the entirety of the South (figure 3.22).

However, the unconditional monophthongization of /ay/ is much more intense in West Texas and in Iron Mountains, where Tennessee, Kentucky, West Virginia, Virginia, and North Carolina meet (figure 3.23).

The lowering of /ey/ is widespread across the entirety of the South, and diffuse (figure 3.24).

The lowering of /iy/ is similarly diffuse, however it shows noticeable hotspots in Chattanooga, Tennesee, and Roanoake, Virginia (figure 3.25).

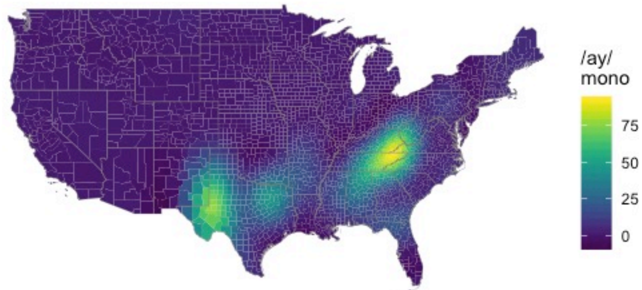


Figure 3.23: /ay/ monophthongization before voiceless consonants

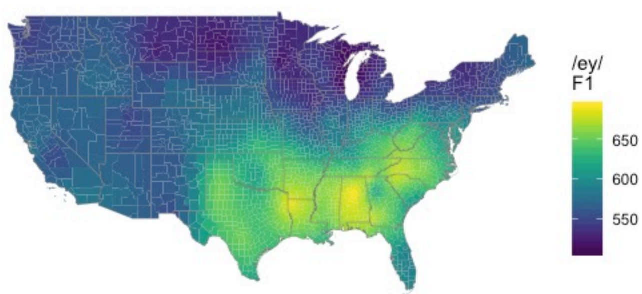


Figure 3.24: Lowering of /ey/ in the ANAE

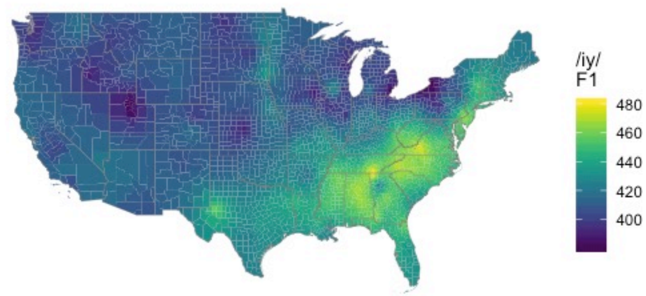


Figure 3.25: Lowering of /iy/ in the ANAE

The tensing of /ae/ is also widespread across the South, however much of the regional variation is obscured by the more intense raising in the North (figure 3.26).

The raising of /e/ is also diffuse, but with hotspots in Birmingham, Alabama and Chattanooga, Tennessee (figure 3.27).

The raising of /i/ is also widespread, and also exhibits more intensity around Birmingham, Alabama (figure 3.28).

When we scale and combine all of the factors that comprise the Southern Vowel Shift, the resulting pattern is much more diffuse than the NCVS, and is consistent with descriptions in the ANAE. However, there is a much higher intensity in a line that runs from Birmingham, Alabama through Chattanooga and Knoxville, Tennessee, up toward where Kentucky, Tennessee, West Virginia, Virginia, and North Carolina meet in the Iron Mountains (figure 3.29).

Examining the Back Upgliding Chain Shift using ANAE data yields similar results, although the data format (mean formant values) and the fact that movement of the same

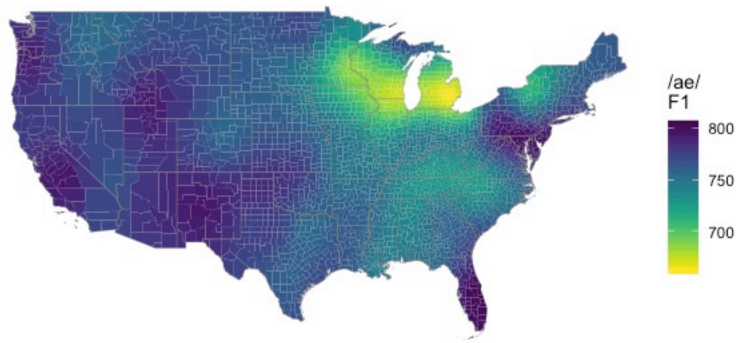


Figure 3.26: Tensing of /ae/ in the ANAE

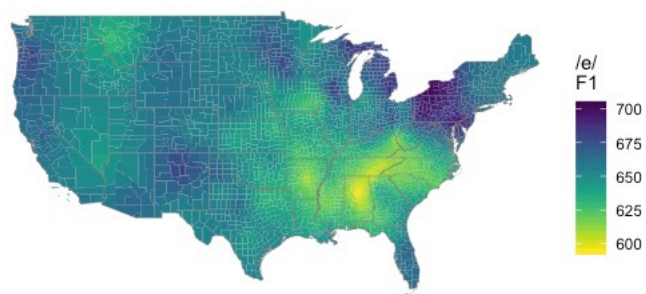


Figure 3.27: Raising of /e/ in the ANAE

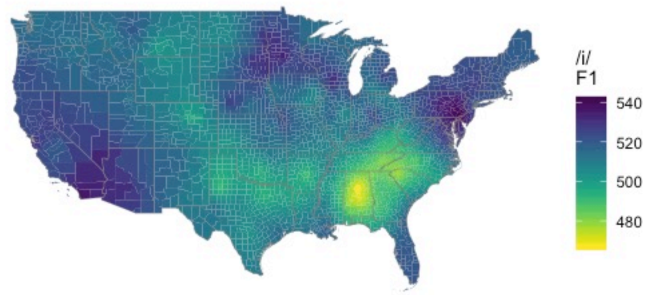


Figure 3.28: Raising of /i/ in the ANAE

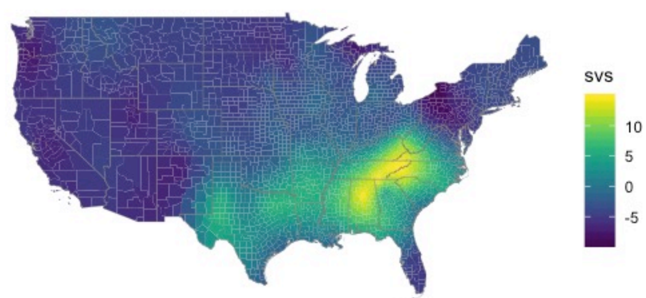


Figure 3.29: The Southern Vowel Shift in the ANAE

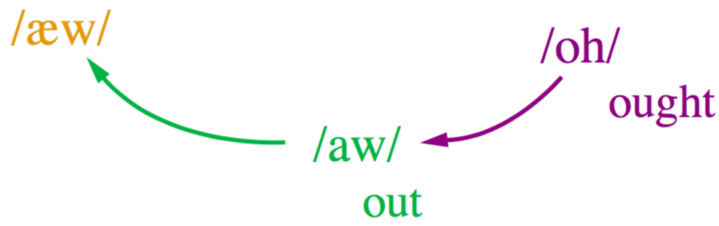


Figure 3.30: The Back Upgliding Shift, after Labov (2005)

vowels is implicated in multiple geographic patterns obscures some of the effect. Combining the fronting of /oh/ with the raising of /aw/ – and including the monophthongization of /ay/, following the authors of the ANAE, results in very similar findings to those in the ANAE.

SVS Kriging discussion

As with the Northern Cities Vowel Shift, the kriging of the ANAE data supports Labov et al.'s analysis, in broad strokes. When we combine kriged maps for all of the vowels implicated in the Southern Vowel Shift, the pattern is consistent with the boundaries proposed in the ANAE, and with a wave model of linguistic diffusion, with a hotspot in the Southeast. This hotspot of the Southern Vowel Shift aligns perfectly with an interstate highway route that cuts a straight line from Birmingham to the North Carolina-Tennessee-Virginia Corners, following I-59 to I-75 to I-40 to I-81. It also aligns perfectly with what the ANAE refers to as the *inland South*.

In the South, we see more unproblematic support for a wave model of diffusion, and a fairly straightforward replication of the findings of the ANAE, both with regards to the Southern Vowel Shift and the Back Upgliding Chain Shift.

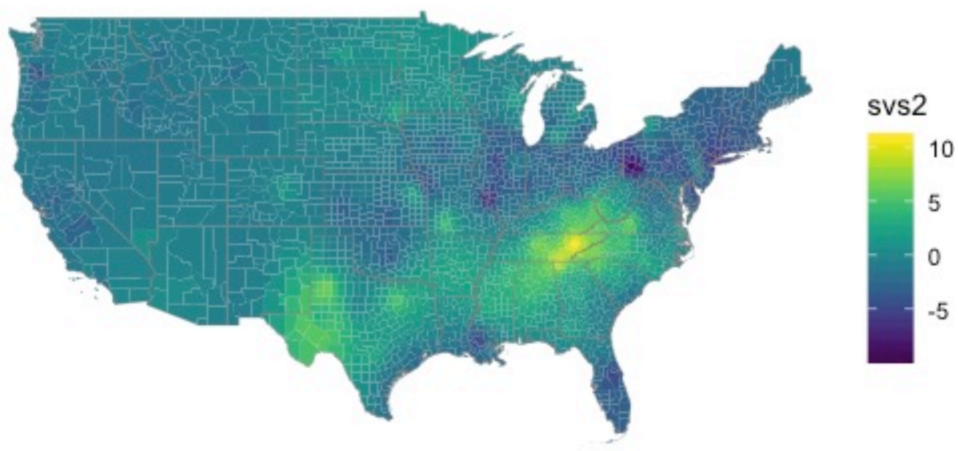


Figure 3.31: The Back Upgliding Shift in the ANAE

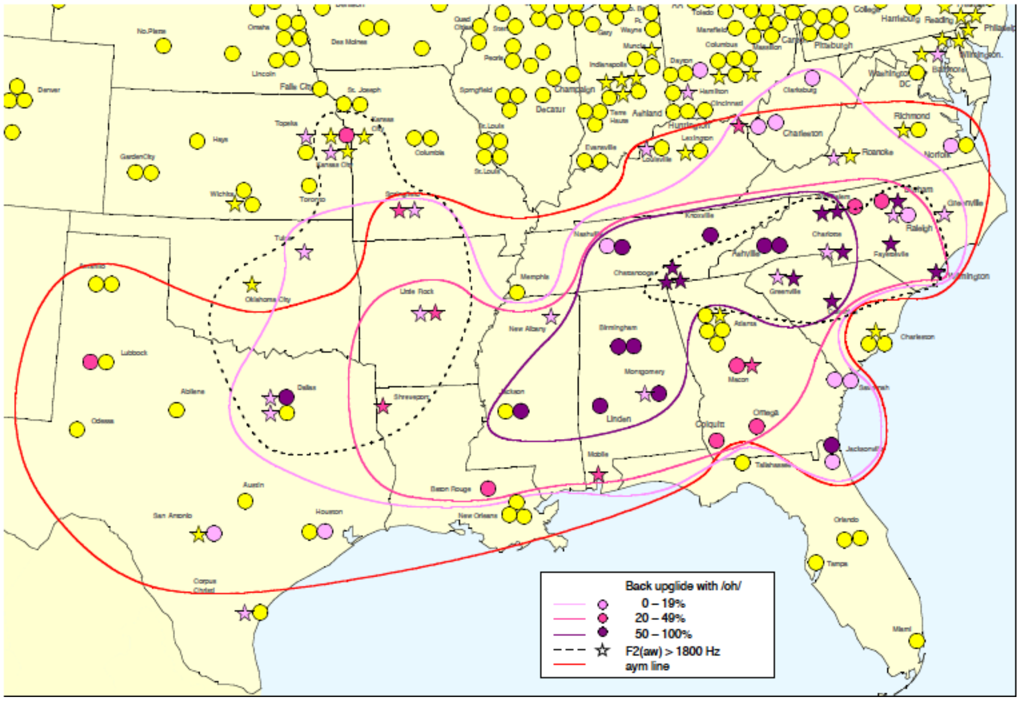


Figure 3.32: The Back Upgliding Shift in the ANAE

3.3.3 Principal Components Analysis

Results of Kriging after PCA

The formant measurements in the ANAE data were sufficiently non-multicolinear as to allow principal components analysis. As such, all of the F1 and F2 measurements were subjected to principal components analysis. Perceptual and production merger data were not used.

An elbow plot reveals that the first and second components account for most of the variation in the data (figure 3.33). The first two components are also the only components that exhibited sufficient spatial structure to allow for kriging, with the first exhibiting significantly more spatial variation than the second (figures 3.34 and 3.35).

Mapping the first principal component results in a map that very clearly captures the layered, north-south component of regional variation, clearly separating the South, Midlands, and Northern Cities, roughly in line with the boundaries proposed in the ANAE. The

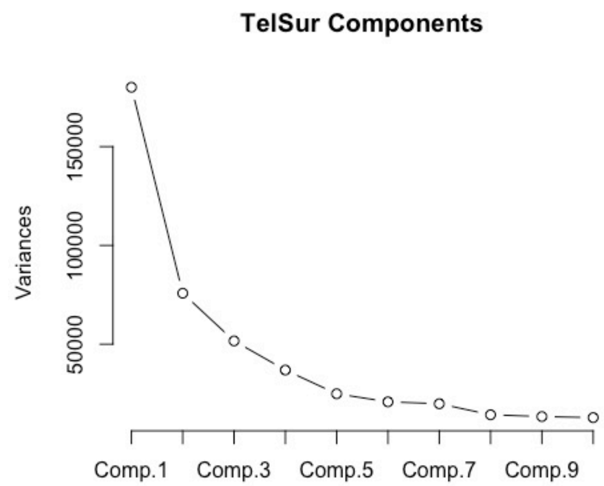


Figure 3.33: Principal Components in the TelSur data

Mississippi river valley is also apparent, although its influence on the first component here is unclear.

The second principal component is suggestive of slight regional variation, primarily picking out the southeastern Mississippi river valley and Alabama, although we should be very cautious of the possibility of over-interpreting statistical artifacts in this case. It is not immediately clear what this regional variation may correspond to, and it accounts for significantly less of the variance than the first principal component (figure 3.33).

Subsequent components do not exhibit interpretable regional variation. As will be shown below, more interpretable results are obtained by first performing Gi* hotspot analysis and then performing PCA on the transformed data.

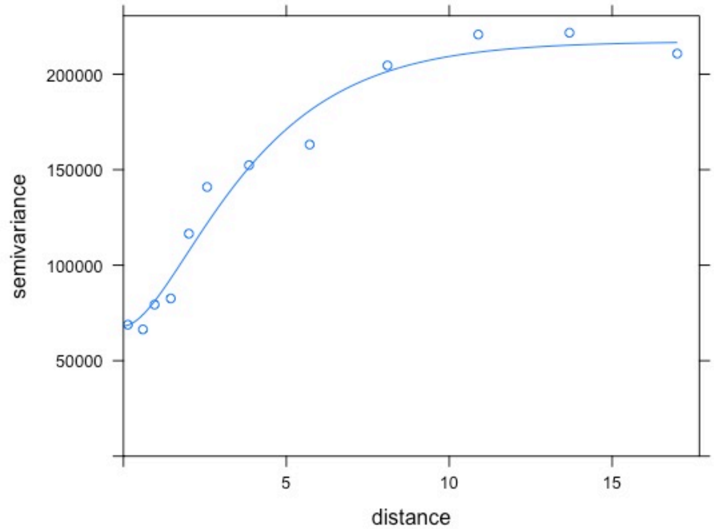


Figure 3.34: Empirical variogram and fitted model for the first principal component (distance in hundreds of miles)

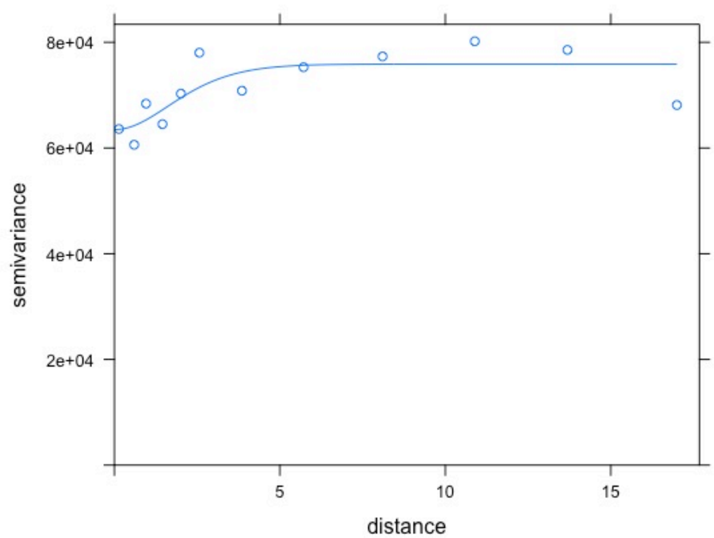


Figure 3.35: Empirical variogram and fitted model for the second principal component (distance in hundreds of miles)

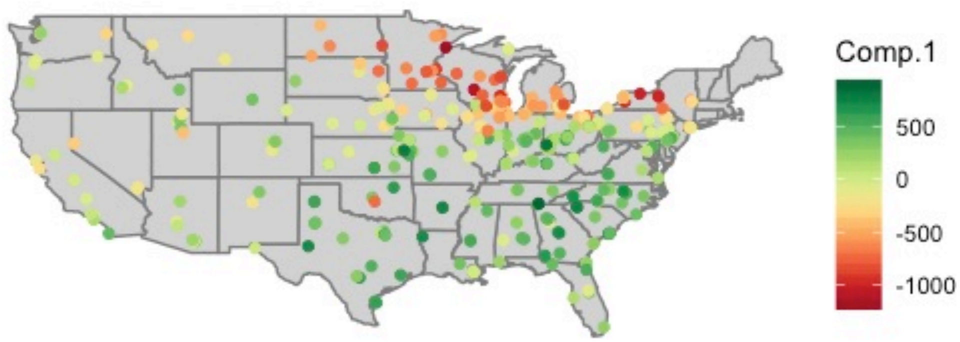


Figure 3.36: Dot map of the first principal component

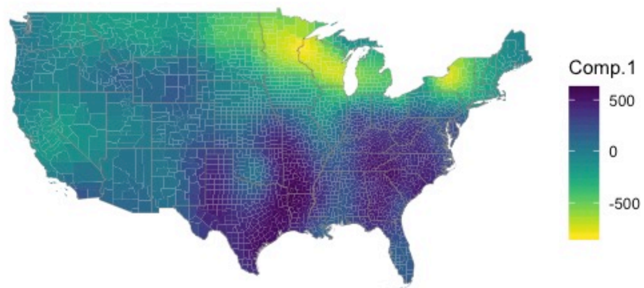


Figure 3.37: The first principal component of the TelSur data (kriged)

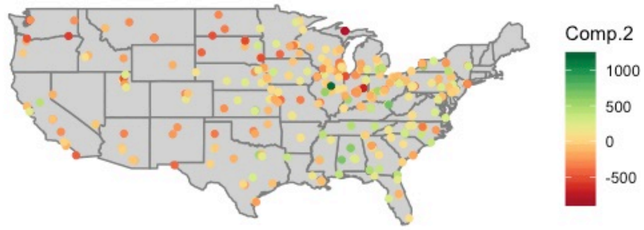


Figure 3.38: The second principal component of the TelSur data

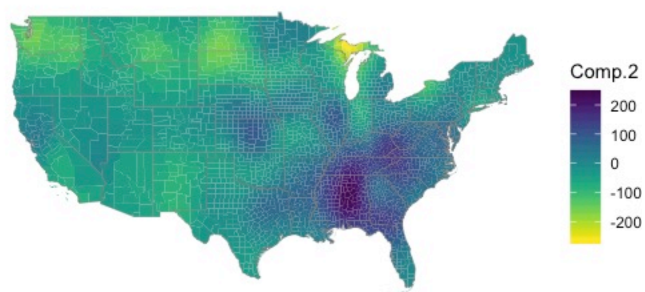


Figure 3.39: The second principal component of the TelSur data

3.3.4 Getis-Ord Gi* Hotspot Analysis

In order to better evaluate regional differentiation in the ANAE, I performed hotspot analysis using the Getis-Ord Gi* statistic, before then smoothing and interpolating the results for readability.

The Getis-Ord Gi* statistic assigns each point observation a z-score, based on comparing the local sum for an observation and its neighbors (based on a predetermined number of nearest neighbors) proportionally against the sum of all observations. When the local sum is very different from the expected sum, we have reason to believe there is a local hot (or cold) spot.

The Getis-Ord Gi* statistic is given by:

$$G_i^* = \frac{\sum_{j=1}^{n} w_{i,j}x_j - \bar{X}\sum_{j=1}^{n} w_{i,j}}{S\sqrt{\frac{\left[n\sum_{j}^{n} w_{i,j}^2 - \left(\sum_{j=1}^{n} w_{i,j}\right)^2\right]}{n-1}}} \tag{3.8}$$

where x_j is the attribute value for feature j, $w_{i,j}$ is the spatial weight between feature i and feature j, n is the total number of features, and:

$$\bar{X} = \frac{\sum_{j=1}^{n} x_j}{n} \tag{3.9}$$

$$S = \sqrt{\frac{\sum_{j=1}^{n} x_j^2}{n} - \left(\bar{X}\right)^2} \tag{3.10}$$

Using points, it is necessary to specify the spatial weights matrix, $w_{i,j}$, using nearest neighbors. For the ANAE, I performed analyses with the 10, 25, and 50 nearest neighbors.

25 nearest neighbors provided the clearest view of regional variation without oversmoothing (discussed in the next section, see figure 3.40).

Gi* results: NCVS

In some respects, the Gi* statistic is an ideal tool for evaluating dialect regions, because it provides a measure of how similar speakers are to one another in a given region; hot spots are suggestive of a regional pattern, and multiple hot spots that are all geographically coterminous meet the criteria that the resulting candidate dialect region is consistent, exclusive, high frequency, and convex – four of the criteria in the ANAE. It also eliminates some of the noise present if we use kriging alone, and allows a clearer view of where people speak more alike and more differently from one another.

Using the NCVS and SVS as test cases, Gi* analysis gives very similar results to the analysis in the ANAE. That is, superimposing the maps for each of the criteria for the NCVS, we achieve comparable results to the ANAE but without subjective decision making affected by “the preconceived notions of the analyst.”

In attempting to avoid decisionmaking based on the preconceived notions of the analyst, I will first present the Gi* data as point patterns – without imposing isoglosses – and then present smoothed and interpolated maps.

The choice of number of nearest neighbors affects the data smoothing. For these data, I performed Gi* analysis with 10, 25, and 50 nearest neighbors (refer to figure 3.40 for a comparison). Given the number of point observations, 25 nearest neighbors gives the clearest view of regional patterns in the data without oversmoothing. In all subsequent maps, 25 nearest neighbors were used for the spatial weights matrix. For all maps, the direction of the color scale represents the intensity of the change associated with the vowel shift, with yellow being more intense participation, and purple being non-participation in the shift.

From the above, it is clear that clustering hot and cold values using a Gi* statistic with

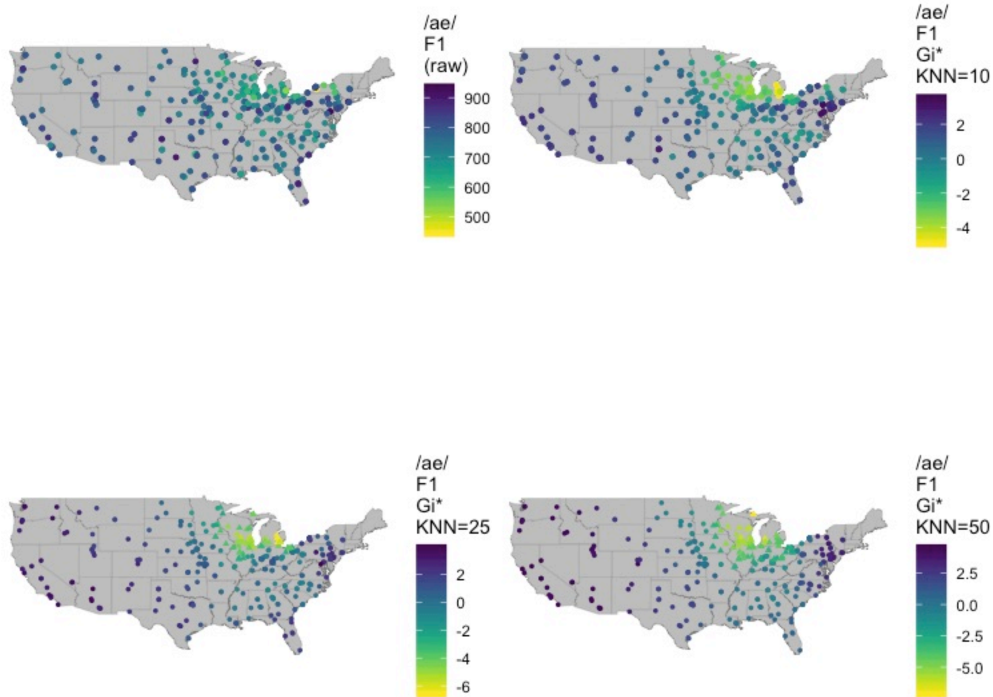


Figure 3.40: Comparison of raw data and Gi* with KNN of 10, 25, 50. Triangles are significant at the 0.05 level

25 nearest neighbors results in point maps that are more interpretable than the raw data. The Gi* point maps do not meaningfully alter our interpretation of the regional patterns made visible by kriging – they simply make the same patterns more apparent in the point patterns.

Gi* results: NCVS (kriged)

Smoothing and interpolating the Gi* data using kriging results in maps that are very similar to the maps produced by kriging the raw data. The main difference is that the smoothed maps of the Gi* data provide more conservative estimates of the geographic spread of hot and cold values (figure 3.53).

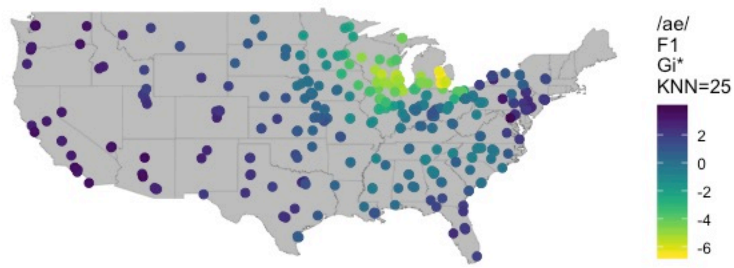


Figure 3.41: F1 of /ae/ Gi* with 25NN

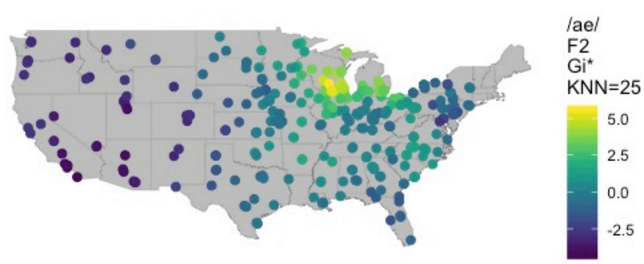


Figure 3.42: F2 of /ae/ Gi* with 25NN

Note that the NCVS pattern visible in the map of kriged Gi* data for F2 of /æ/ is very similar to that in the kriged map of the untransformed data, however the Gi* data better captures the backing of /æ/ in California and the Western states (figure 3.55).

Caution should be exercised in interpreting the results of kriging after performing Gi*

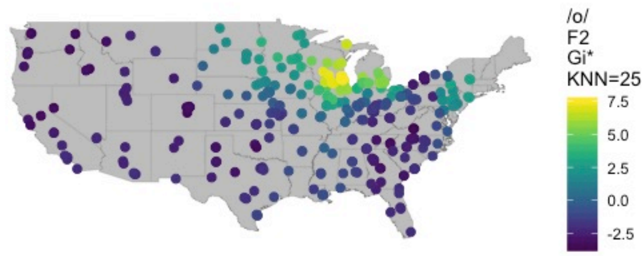


Figure 3.43: F2 of /o/ Gi* with 25NN

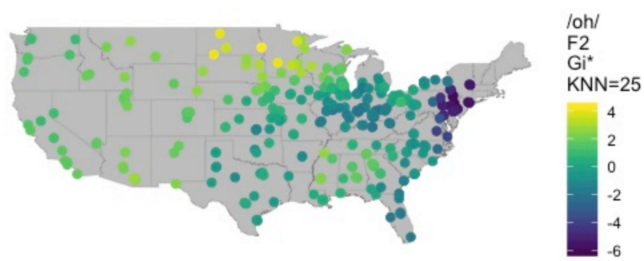


Figure 3.44: F2 of /oh/ Gi* with 25NN

analysis, especially around the borders, or in areas with low data density. For instance, figure 3.63 and figure 3.61 would appear to suggest a hot spot of lowering of the F1 of /e/ and of /i/ in Maine – however, this is a statistical artifact; the result of a trend in eastern New York (near the boundary of available data) being extended into parts of New England that lacked

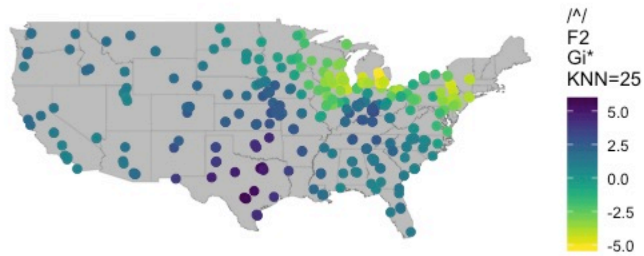


Figure 3.45: F2 of /ʌ/ Gi* with 25NN

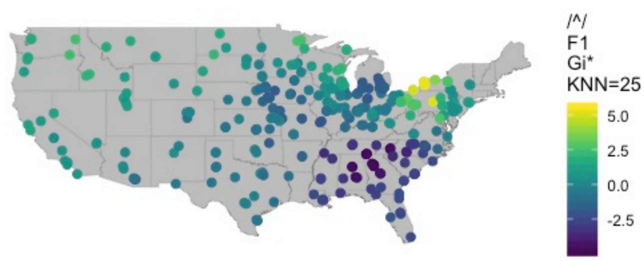


Figure 3.46: F1 of /ʌ/ Gi* with 25NN

any measurements (viz figures 3.47 and 3.49). When the maps are superimposed, again, the Northern Cities Vowel Shift emerges from the data, and these artifacts are corrected for.

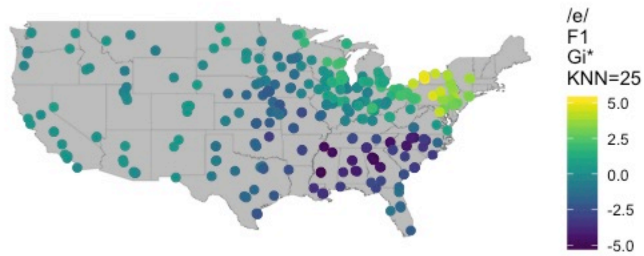


Figure 3.47: F1 of /e/ Gi* with 25NN

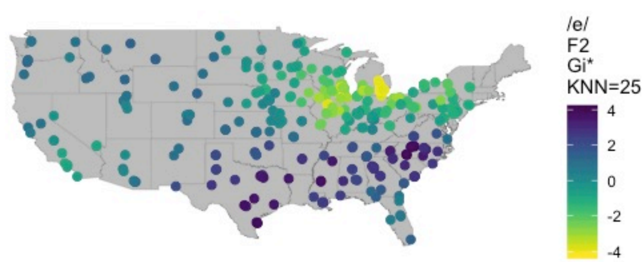


Figure 3.48: F2 of /e/ Gi* with 25NN

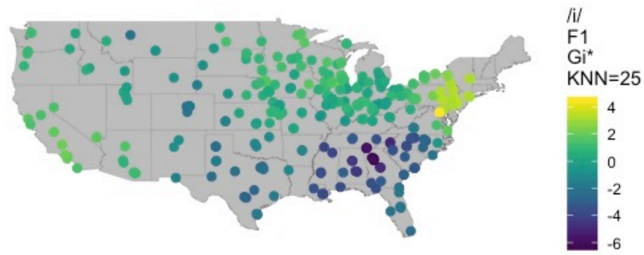


Figure 3.49: F1 of /i/ Gi* with 25NN

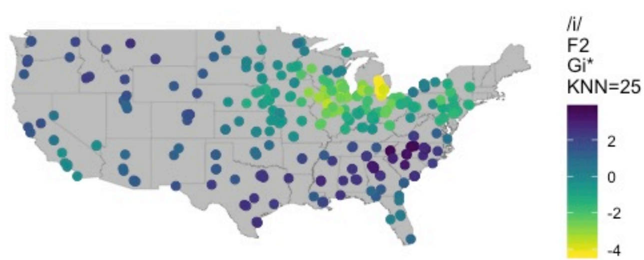


Figure 3.50: F2 of /i/ Gi* with 25NN

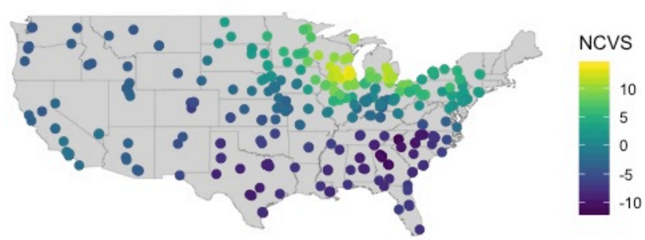


Figure 3.51: NCVS Gi* scores superimposed with 25NN

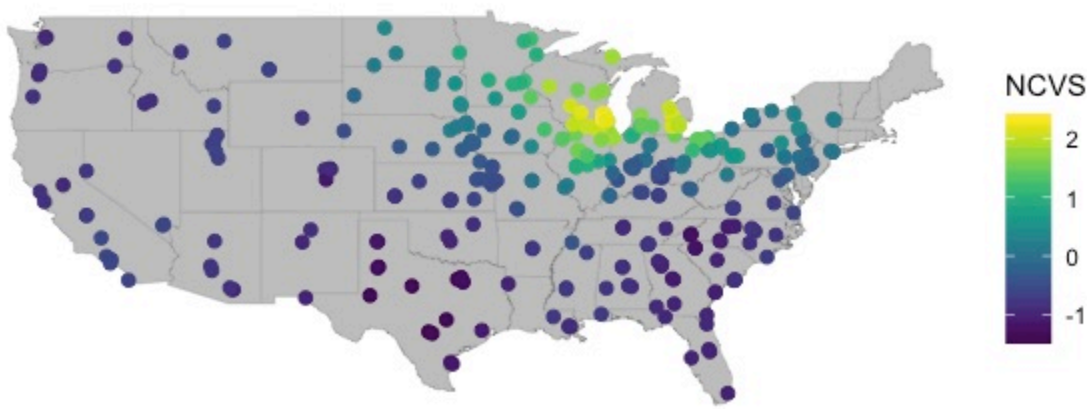


Figure 3.52: The Northern Cities Vowel Shift (scaled and superimposed Gi* maps)

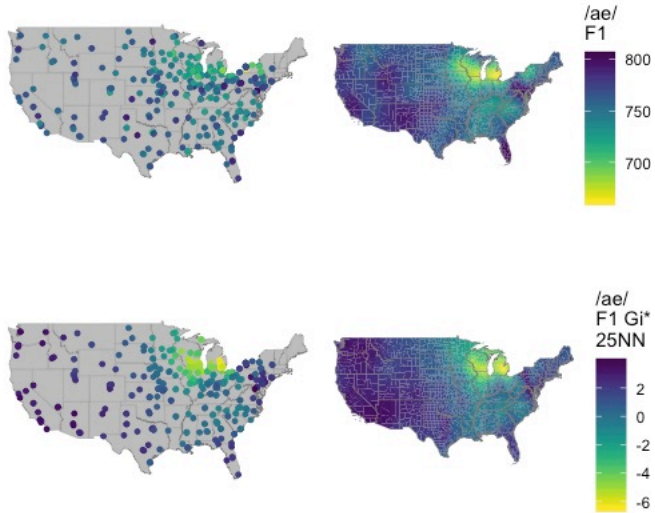


Figure 3.53: Comparison of raw and Gi* (KNN=25) maps for F1 of /æ/

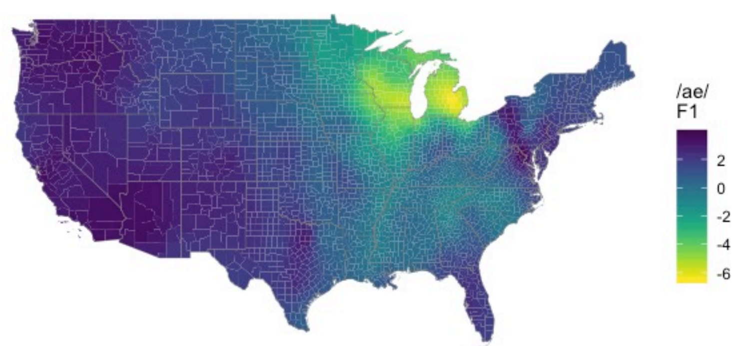


Figure 3.54: F1 of /æ/ Gi* 25NN (kriged)

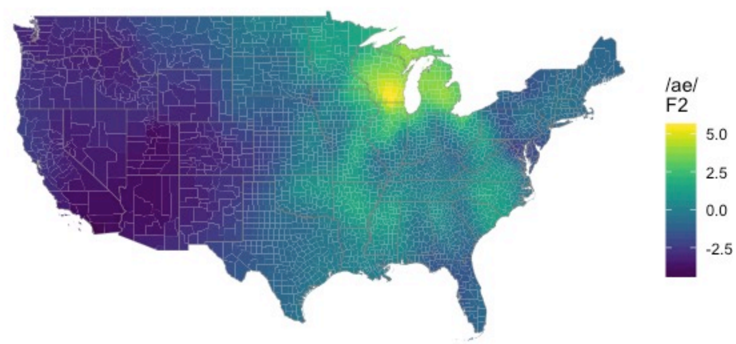


Figure 3.55: F2 of /æ/ Gi* 25NN (kriged)

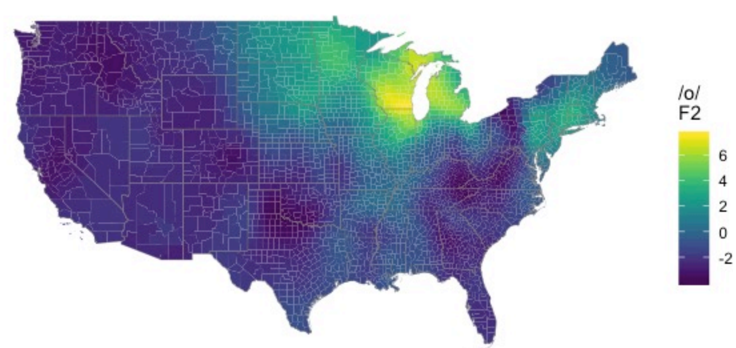


Figure 3.56: F2 of /o/ Gi* 25NN (kriged)

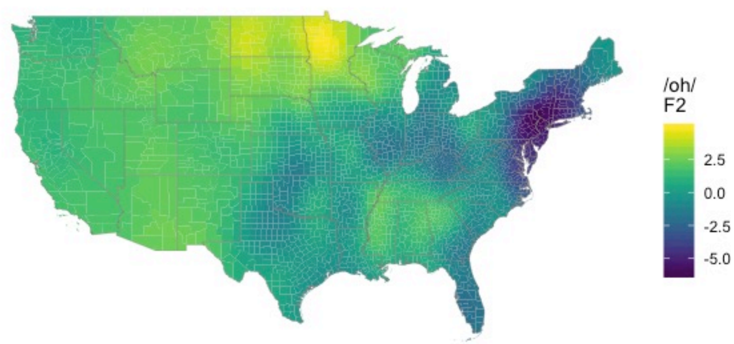


Figure 3.57: F2 of /oh/ Gi* 25NN (kriged)

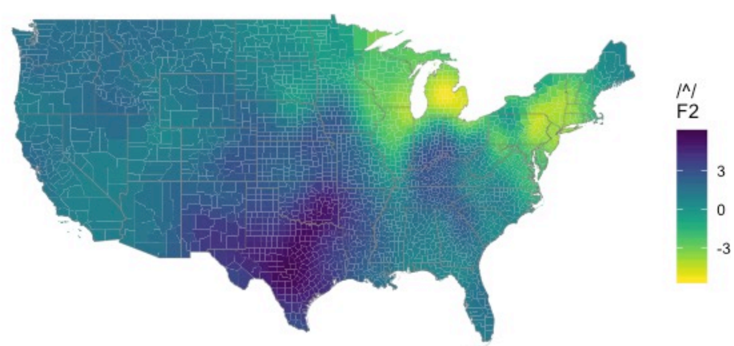


Figure 3.58: F2 of /ʌ/ Gi* 25NN (kriged)

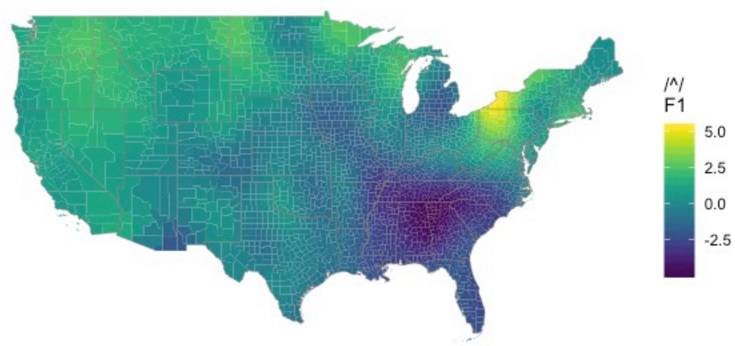


Figure 3.59: F1 of /ʌ/ Gi* 25NN (kriged)

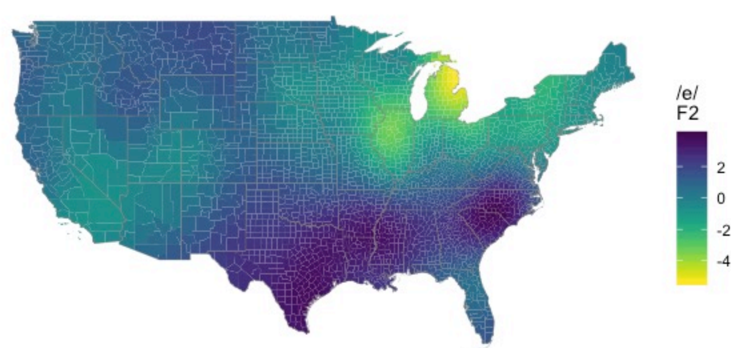


Figure 3.60: F2 of /e/ Gi* 25NN (kriged)

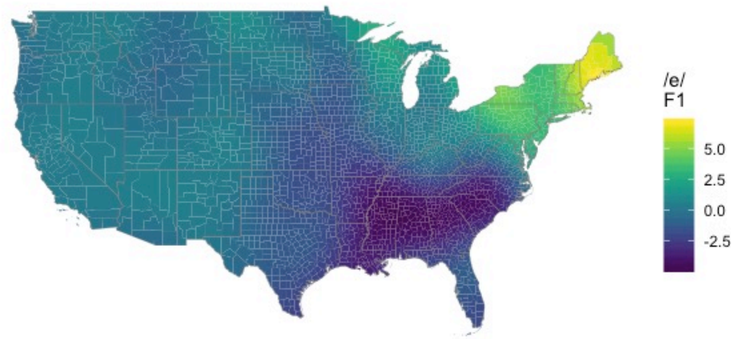


Figure 3.61: F1 of /e/ Gi* 25NN (kriged)

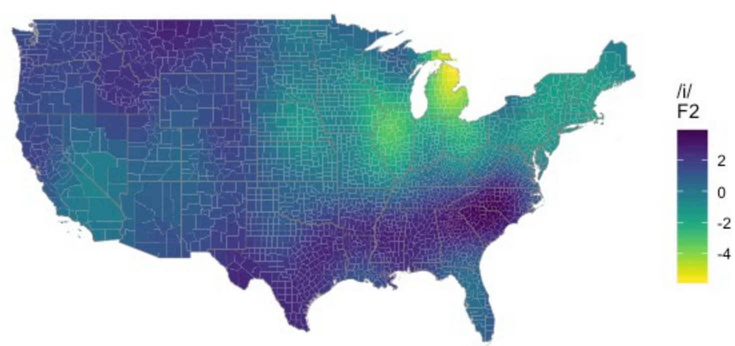


Figure 3.62: F2 of /i/ Gi* 25NN (kriged)

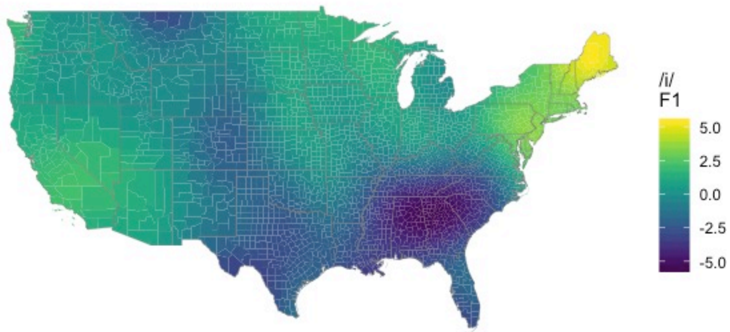


Figure 3.63: F1 of /i/ Gi* 25NN (kriged)

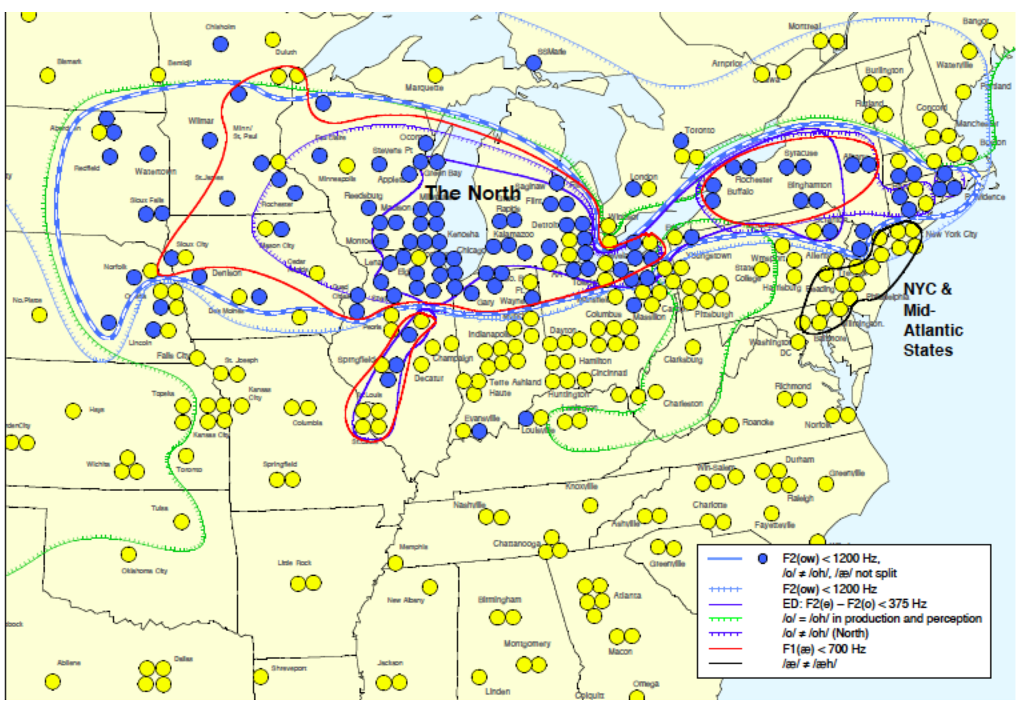


Figure 3.64: The Northern Cities Vowel Shift (ANAE)

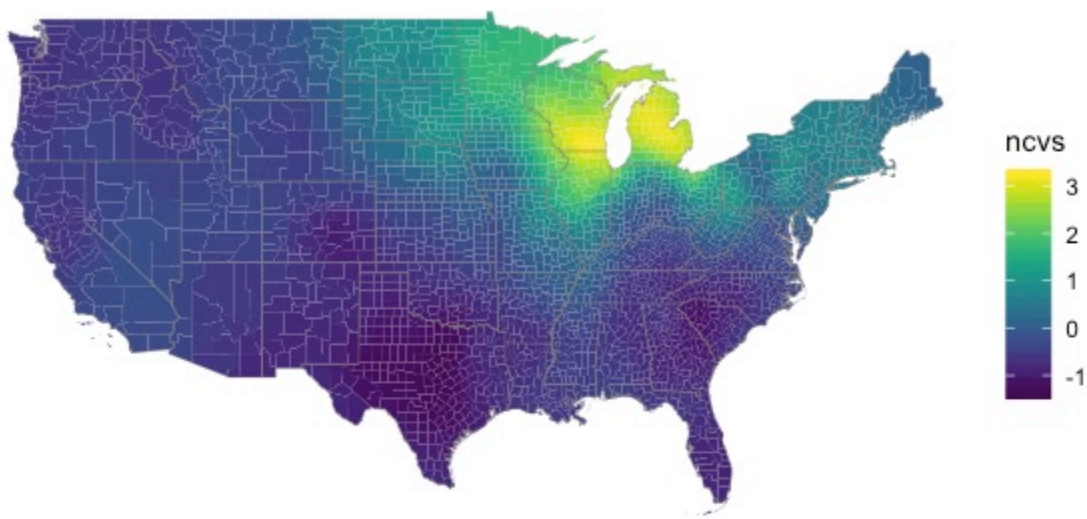


Figure 3.65: The Northern Cities Vowel Shift (scaled and superimposed Gi* maps, kriged)

Gi* results: SVS

Performing Gi* analysis on the vowel data for the Southern Vowel Shift resulted in much the same as with the NCVS. The patterns described in the ANAE are present as anticipated. Gi* analysis was not performed on the /ayV/ (*time, sigh*) and /ayC/ (*night, like*) data because the vast majority of the observations were equal to zero, and Gi* analysis is not always reliable or useful with zero-inflated data. However, the intensities are very clear from the kriged data alone, and the raw (point) data is presented here for the sake of completeness (figures 3.66 and 3.67). As with the kriged data above, examining the F1 of /æ/, the much greater raising of /æ/ in the NCVS makes the SVS raising of /æ/ less clear in comparison.

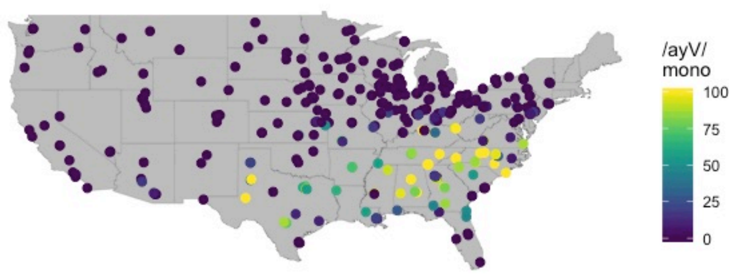


Figure 3.66: Monophthongization of /ay/ not before voiceless consonants

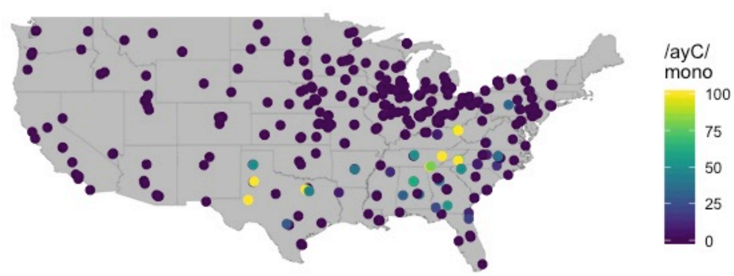


Figure 3.67: Monophthongization of /ay/ before voiceless consonants

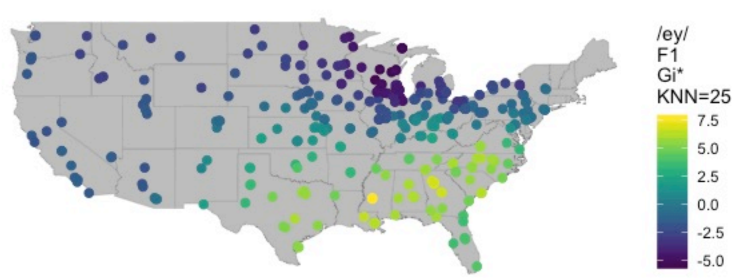


Figure 3.68: F1 of /ey/ Gi* 25NN

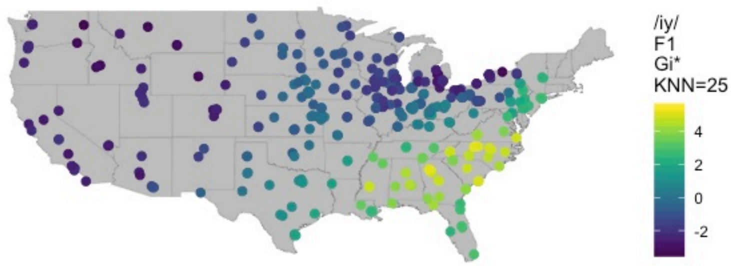


Figure 3.69: F1 of /iy/ Gi* 25NN

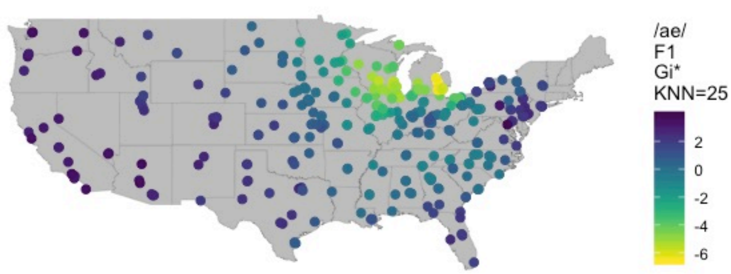


Figure 3.70: F1 of /æ/ Gi* 25NN

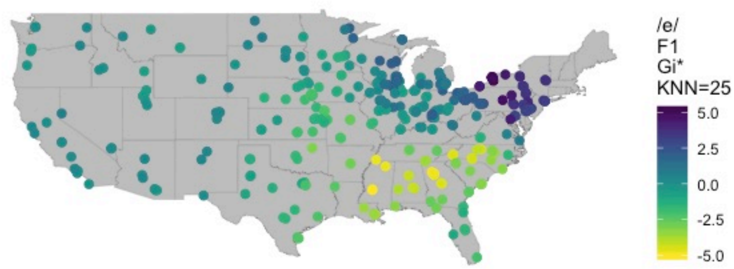


Figure 3.71: F1 of /e/ Gi* 25NN

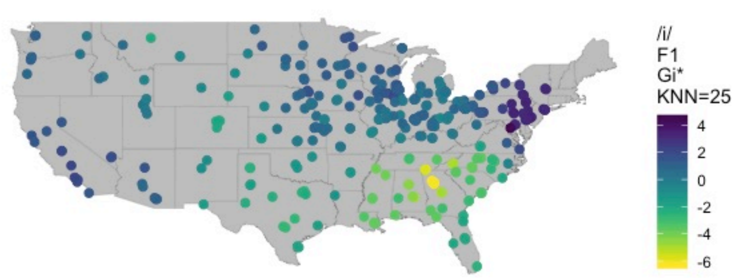


Figure 3.72: F1 of /i/ Gi* 25NN

Gi* results: SVS (kriged)

As with the NCVS data, performing kriging to smooth and interpolate the Gi* data for the SVS results in similar predictions as kriging the raw data alone. Here, however, the strong regional character of the Southern Vowel Shift is more apparent.

The ANAE treats the unconditioned monophthongization as the first major stage of the Southern Vowel Shift, the reversal of the nuclei of /ey/ and /e/ as the second stage of the Southern Vowel Shift, and the reversal of the nuclei of /iy/ and /i/ as the third stage of the Southern Vowel Shift. These stages are determined in the atlas as follows:

Stage 1: Unconditional monophthongization of /ay/

Stage 2: F1 of /e/ $<$ F1 of /ey/

F2 of /e/ $>$ F2 of /ey/

Stage 3: F1 of /i/ $<$ F1 of /iy/

F2 of /i/ $>$ F2 of /iy/

Again, the expectation is that there was a triggering event that spread outward from one location, followed by subsequent changes as shifts in the vowel space place internal pressures on the rest of the vocalic system. In this case, the empirically observed data strongly support this model: the monophthongization of /ay/ is the most widespread, followed by the second stage reversal of /ey/ and /e/, and lastly by the third stage reversal of /iy/ and /i/ – and the geographic spread of these changes suggests greatest intensity in the northern parts of Mississippi, Alabama, Georgia, and western South Carolina. Unlike the NCVS data above, the SVS data offer no challenges to a wave or cascade model of diffusion.

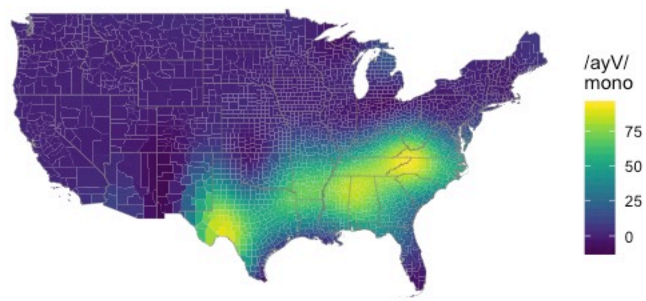


Figure 3.73: /ay/ monophthongization not before voiceless consonants

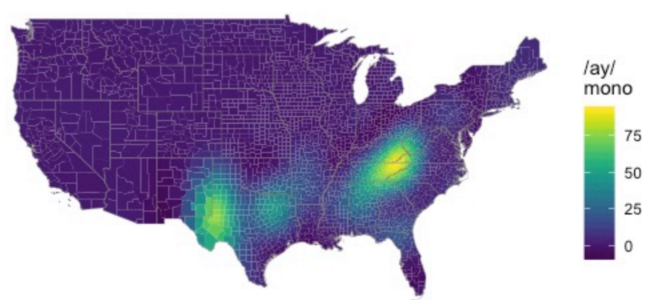


Figure 3.74: /ay/ monophthongization before voiceless consonants

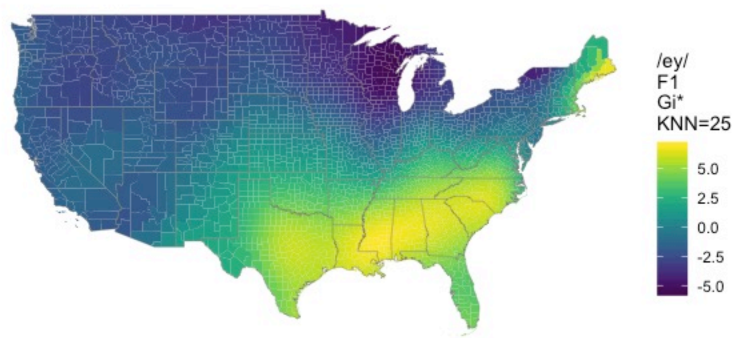


Figure 3.75: F1 of /ey/ Gi* 25NN

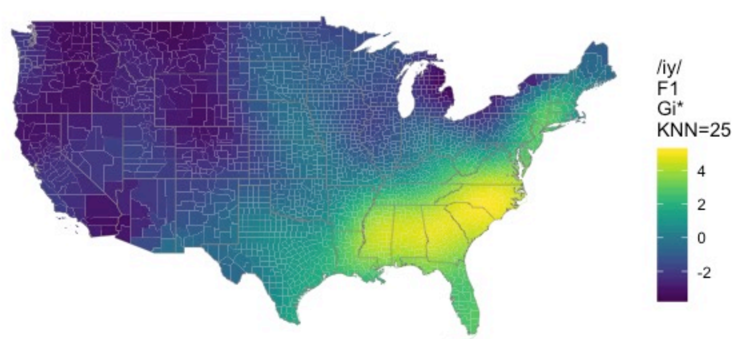


Figure 3.76: F1 of /iy/ Gi* 25NN

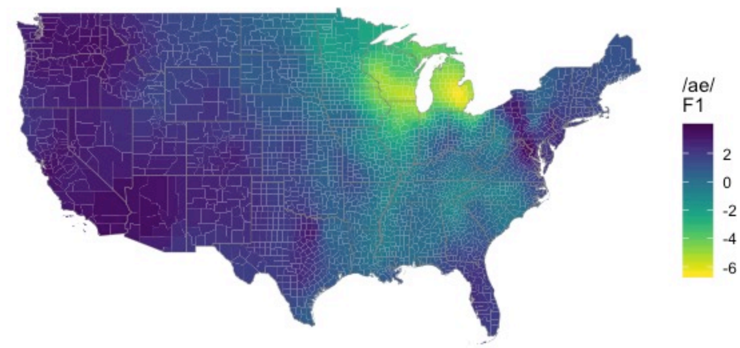


Figure 3.77: F1 of /æ/ Gi* 25NN

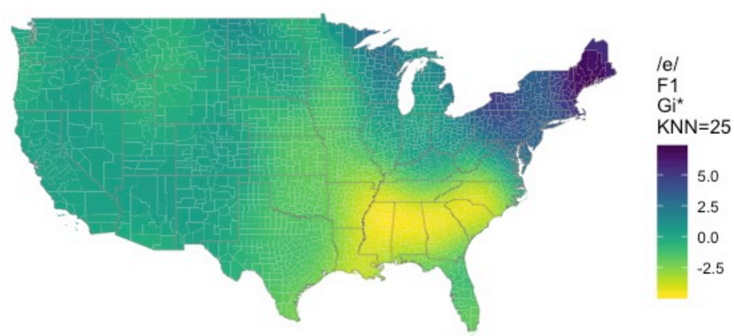


Figure 3.78: F1 of /e/ Gi* 25NN

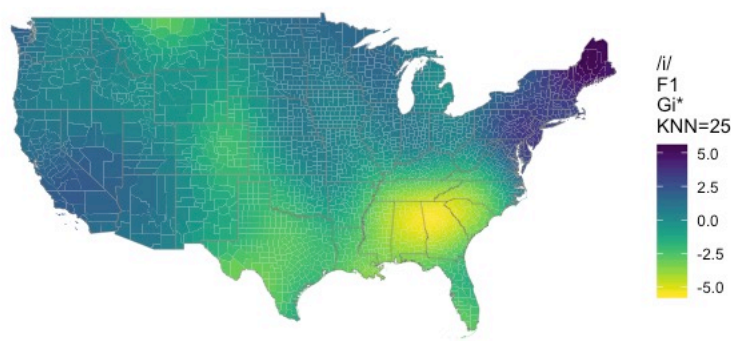


Figure 3.79: F1 of /i/ Gi* 25NN

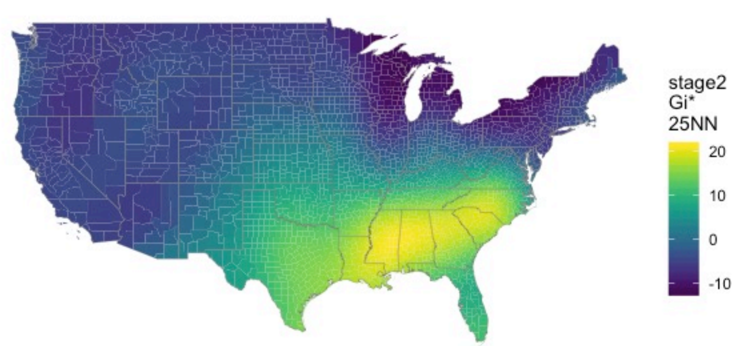


Figure 3.80: Stage 2 of the SVS, Gi* 25NN

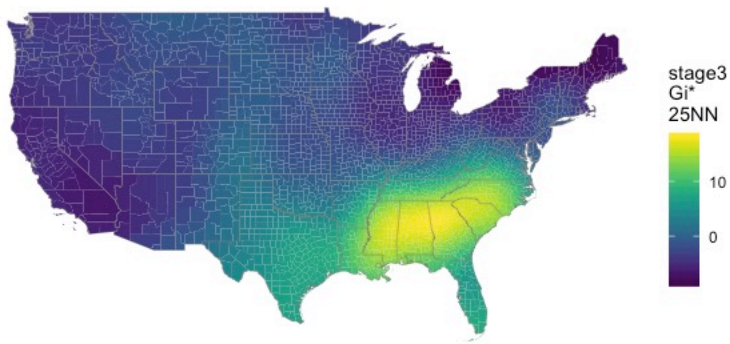


Figure 3.81: Stage 3 of the SVS, Gi* 25NN

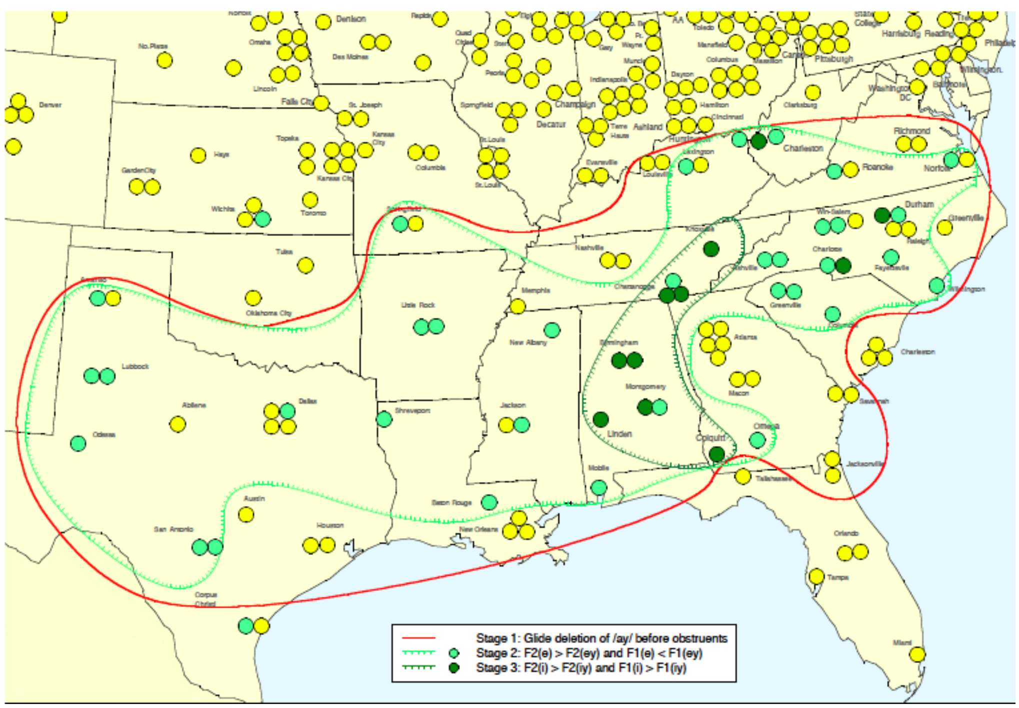


Figure 3.82: The Southern Vowel Shift (ANAE)

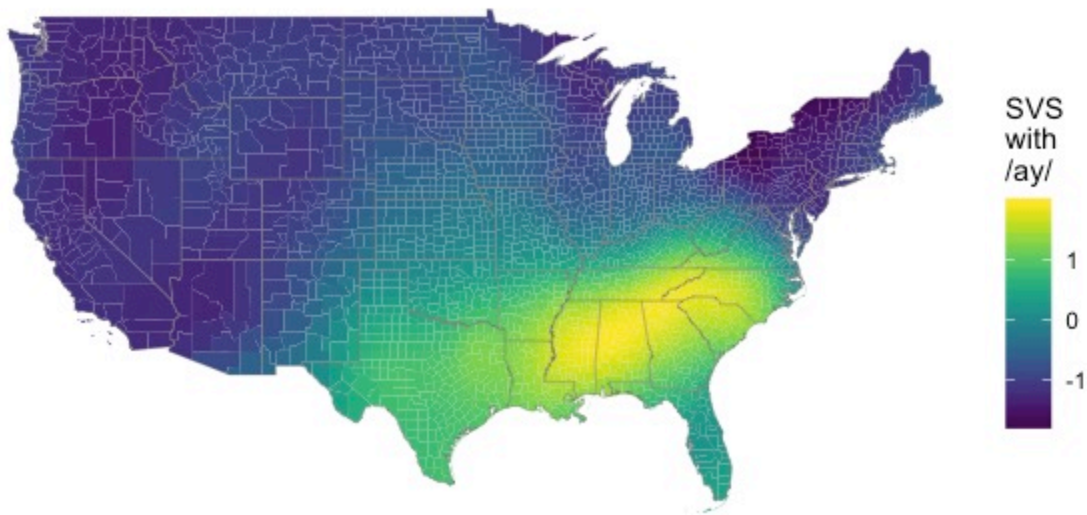


Figure 3.83: The SVS, Gi* 25NN (scaled and superimposed Gi* maps kriged, including /ay/ monophthongization)

Gi* and PCA

Principal Components analysis on the Gi* data using 25 nearest neighbors resulted in a similar outcome as with the raw data, above. As with the previous discussion of PCA, the first component alone accounted for the overwhelming majority of the variance, and in this case, all of the interpretable spatial variance. As with the previous discussion, the resulting spatial pattern was a strong north-south differentiation in the eastern half of the country, and a broadly undifferentiated West. Comparing to a smoothed map of the first principal component of the raw data (figure 3.37), we find a similar spatial pattern, but as with all of the Gi* transformed data, the geographic 'hot' and 'cold' areas are more consistent with the analysis in the ANAE, picking out the Northern Cities and the South, as distinct from the Midlands, East Coast, and West (figures 3.84 and 3.85). The Mississippi river valley is no longer apparently distinct from the rest of the South, consistent with the ANAE findings.

3.4 Discussion

There are two key takeaways from this chapter. First, and most importantly, contemporary computational and geostatistical methods largely corroborate the findings of the *Atlas of North American English*. This is important for future research and for the next chapter, because kriging and Gi* hot-spot analysis faciliate comparison between two data sets which have samples taken at different locations. The point is that we can use the above methods to investigate regional patterns in African American English, from speakers sampled at different locations, and be reasonably confident that our results are directly comparable to the ANAE. Moreover, the fact that these methods corroborate the ANAE suggests we can believe the findings in the next chapter as well as we can believe the findings in the ANAE, as these methods produced very similar results in the analysis of the ANAE to the accepted standard.

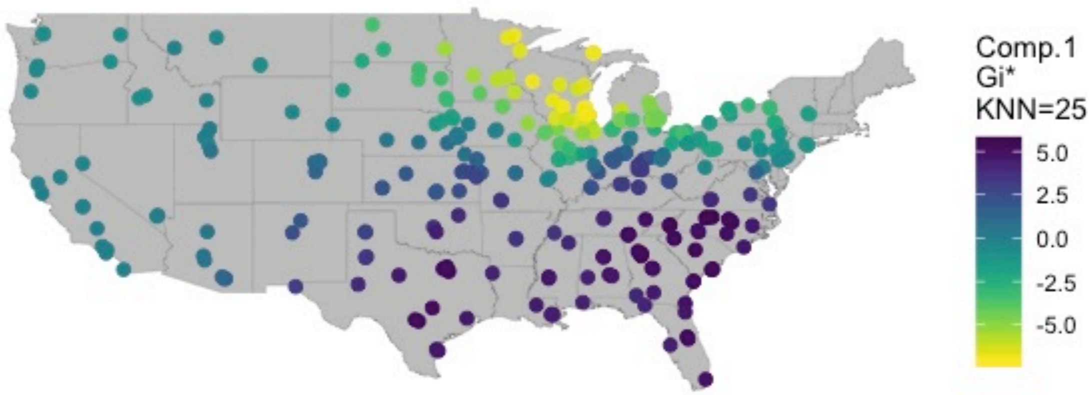


Figure 3.84: Principal Components in the TelSur data, Gi* with KNN=25

Second, the methods used above add a degree of nuance to our understanding of the ANAE data beyond what was possible with analytic methods used in the ANAE. While the patterns described in the ANAE are broadly confirmed, the above raises some difficult questions for traditional approaches to chain shifts and dialect regions: if standard assumptions in the field about actuation and diffusion of linguistic changes are correct – that the NCVS, for instance, was triggered by one change which spread geographically from its origin, and other aspects of the vowel shift followed, ostensibly starting precisely where the first change was most advanced (Gordon, 2002; Labov et al., 2005; Trudgill et al., 1974) – then a statistical approach which removes the "preconceived notions of the analyst" poses a challenge for our

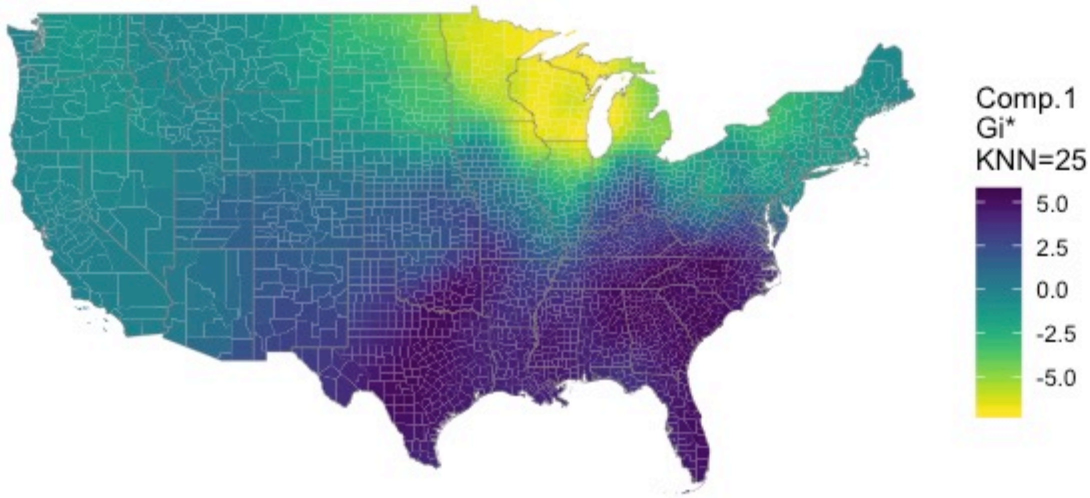


Figure 3.85: Principal Components in the TelSur data, Gi* with KNN=25

understanding of chain shifts. The observed pattern of change, and the observed intensity of those changes, do not conform to existing theoretical models of geographic spread of sound change – indicating an opening for future theoretical research. It may be the case that geographic patterns of sound change in the United States are a special case: not only is the US a much younger country than, for example, France or Germany – where the first major studies of dialect geography were undertaken – but the history of the US is also shaped by slavery, anti-black racism, and segregation. If Van Herk's suggestion is correct, we may not be able to rule out anti-black racism, residential and educational segregation, and xenophobia as initial triggers for the NCVS (Van Herk, 2008). As will be shown in the next chapter, there is compelling evidence that patterns of segregation and redlining may have an effect on AAE regional variation, sometimes unexpected ways. Interstate highways and a national rail system combined with intense redlining and segregation in destination cities during the Great Migration could mean that the NCVS is a very different kind of sound shift than previous models sought to explain. It is therefore possible that each of the cities implicated in the NCVS both experienced its own probabilistic trigger at the local population level, and that inter-city intra-ethnic contact at the supra-local level resulted in cross pollination giving rise to a larger vowel shifting at the regional level. Such a system could be modeled to test this hypothesis, though this exciting possibility for future research is beyond the scope of this dissertation. Ultimately the challenges the above analyses pose for traditional theories of geographic spread of sound change may simply be indicative of complicating factors in regional variation in the United States, and not necessarily challenges to existing models of sound change like the wave model or gravity model, that have been demonstrated to have strong explanatory power in other instances of sound change.

In the next chapter, I turn my attention to a regional survey of the vocalic system of African Americans, and the results of applying the same statistical analyses to these new data.

Chapter 4

African American English

4.1 Introduction

This chapter investigates regional patterns of variation in African American English. The study of regional variation in AAE on a national scale has never before been successfully performed, for a variety of reasons, including a lack of funding availability when the *Atlas of North American English* (Labov et al., 2005) was being compiled (Labov, p.c.). While there are some current attempts to create nationally representative corpora of AAE underway, most notably the Corpus of Regional African American Language (CORAAL, Kendall 2018), as of yet there is no regionally representative corpus of spoken AAE researchers can consult.

This dissertation represents, in part, the first national sample of spoken AAE. In order to collect and analyze the data for this chapter, new methods and new technologies were required. In the following sections, I discuss the data collection, data processing, and data analysis, before moving on to the findings. Finally, I discuss the implications of the findings.

The key questions under consideration are:

- Is there regional variation in AAE or is it homogeneous?
- If there is regional variation in AAE,
  - does that variation pattern with the variation described in the ANAE?
  - Does the proposed African American Vowel Shift (AAVS) accurately characterize AAE? Can regional variation be characterized solely in terms of the AAVS?

As will be shown below, there is, in fact, a great deal of regional variation in AAE, and neither the dialect regions described in the ANAE nor the proposed AAVS can accurately account for the variation exhibited in this sample.

4.2 Methods

Both data collection and data analysis required new approaches – in part to make the input compatible with standard data processing tools, in this case, FAVE (Rosenfelder et al., 2014), – and in part to make the resulting processed data comparable with previous analyses. That is, there was no satisfactory existing method for gathering spoken AAE quickly on a national scale, and once that problem was solved, the resulting data was not directly comparable with the ANAE without introducing new methods, such as kriging, discussed in the previous chapter.

4.2.1 Data Collection

Data collection was primarily performed using a snowball sample on social media. This approach was not possible in 1995, when data collection for the ANAE was undertaken. More importantly, the methods used in the ANAE are no longer possible to imitate.

The methods used in the ANAE were not viable for this study for a variety of reasons. First, the rise of cell phone use means that calling land lines now has a much lower likely success rate, and systematically biases the sample toward the elderly. Second, regardless whether it is a land line or a cell phone, potential subjects are unlikely to answer a cold call from an unknown number – in 1995 there was no way of knowing, at a glance, while the phone was ringing, who the caller was (although you could use *69 after to find out the number of the call you just missed). Third, AAE speakers are an ‘at-risk’ population not only unlikely to answer unknown callers, but also unlikely to respond to an unknown white researcher asking to have a conversation, in part because of negative language attitudes around AAE. This means that even were I able to get a large enough sample of speakers over the phone, I also risked a systematically biasing interviewer effect (Rickford and McNair-Knox, 1994).

To overcome these challenges, I made use of a new reading passage, shared over social media. This had the benefit of allowing participants time to think about participation and to evaluate the researcher's apparent stance toward AAE speakers (and black people more generally), by evaluating my social media presence and blog. Moreover, as the sample grew, participants heard about it from their friends, family, and acquaintances who had already participated, rather than an out-group stranger. There is no expectation that friend networks would systematically bias the results, and in fact the use of such networks is standard in sociolinguistic interviews (see, for example, Wendell Harris's interviews in the PNC, or Minnie Quartey's DC interviews in CORAAL). The majority of participants heard of the study through social media, however there were a few who were either friends or who were acquaintances who took an interest after learning about the study (for instance, a number of Naval enlisted men and officers participated, after I correctly identified their home states or counties from their accents.

The study protocol consisted of two parts: a brief demographic survey, and the new reading passage "Junebug Goes to the Barber". The demographic survey asked age range (in decades), hometown, home state, name of local high school, highest level of education, sex, and how the participant heard about the study. Because the demographic questionnaire asks age, hometown, and high school, it is possible to construct an estimate of residential and educational segregation for the participants' critical language learning years. Parent's origin was not requested, and so was not available.

There were some who suggested a reading passage may have drawbacks, arguing that there may be a "reading effect" that prompted code-switching toward white norms, and arguing that it may bias the sample because of high rates of illiteracy among black people. The former was not a problem, in part because *Junebug* was designed to address this problem (see below for further elaboration). The question of literacy is a misguided concern. In fact, black folks are not illiterate at a higher rate than their white counterparts (in fact, black illiteracy is lower, see Rooney et al. 2006). Moreover, precisely the desired target demographic has historically been overrepresented on social media (Pew Research Center, 2019), and enthusiastically engages not just with the written word, but with written AAE (Jones, 2015b, 2016b). Ultimately, there was sufficient participation from the desired speakers, so concerns about literacy proved to be unfounded.

A new reading passage was designed to avoid the shortcomings of existing reading passages with regards to AAE. Previous reading passages did not measure all, or the most relevant, vowel classes. They also tended to create a strong reading effect when I piloted them with AAE speakers, in part because of their use of stilted, academic language. This would, of course, also bias participants toward trying to "sound white". Many are also, to put it bluntly, strange. "Comma Gets a Cure", for example, is a bizarre story about an obscenely wealthy woman who pays an exorbitant amount of money for veterinary treatment for her exotic pet, and as such, is not a relatable story for most people. "Arthur the Rat" is difficult to convince people to read once they hear the off-putting name. The "Rainbow passage" is folksy in a culturally white way, and is too short to elicit multiple tokens of the relevant lexical sets.

The new passage was written to reflect a specifically Black American cultural context, to minimize code switching and encourage use of AAE, to minimize a reading effect, and to elicit multiple tokens of all relevant word classes. The story follows Marcus Junior, who "everyone just calls 'Junebug'" following African American folk conventions, as he walks through his neighborhood on his way to the barbershop to get his first haircut alone, before his twelfth birthday party. He meets various characters along the way, including Miss Mary, the local busybody, Mr. Robertson, the jazz musician who makes a living playing church music, and his barber Terrence (who goes by "Mac"). A significant portion of the reading passage is quoted conversation, which allowed for it to be written in a way that elicits spoken AAE (e.g., copula deletion in "where you off to without your mama?"), and the narration is written in an informal conversational style – the idea being that speakers won't feel a need to code switch away from the vernacular register when reading the narrative. There are a number of black American cultural shibboleths built into the reading passage, including the use and choice of nicknames, the use of AAE specific grammatical features like quotative *talkin' 'bout* (Jones, 2016a) and negative concord, cultural references, and idioms (e.g., "you must be feelin' yourself," and "always come correct."). If speakers did not exhibit well documented AAE features like coda reduction, *and* they were audibly confused by AAE shibboleths like *gon'* instead of *gonna*, what a *cookout* is, and the use of the name *Junebug*, those participants were excluded from analysis (although this was only the case for two participants).

The reading passage therefore encouraged AAE use without imposing it (outside of direct quotes, like "where your momma at?" which the vast majority of people did not change). It also was designed with a number of AAE specific questions in mind: there are enough tokens of words ending in -ING to allow investigation of regional patterns of pronunciation of words like *thing*, *sing*, and *bring* – inspired by the enregistered use of EY in expressions like "it ain't no *thang*" or "that girl wadn't singin' she was *sangin'*". Similarly, there are enough tokens of relevant words to allow measurement of the PIN-PEN merger and the FEEL-FILL merger.[1]

Finally, the passage is relatively short, fitting on one page, and was validated by both native AAE speaking laymen, actors, and linguists. Participants were encouraged to change anything in their reading of it that struck them as egregiously "not black", "not AAE", or "regional", and discussed it at length on Twitter and Facebook (Most notable was an AAE preference for *everybody* instead of *everyone*, born out also in data from CORAAL).[2].

[1]This latter is in theory – in practice there were not always enough tokens after analysis in FAVE to allow comparison. However, it is still possible to determine whether words in the FEEL class are closer to /iy/ or /i/.

[2]That discussion can be found here: https://twitter.com/languagejones/status/1056940981566750721. The other main locus of variation was a preference for "tell your mama 'nem I say '*hey*'" [he͡ɪ], instead of "...I say '*hi*'" [ha͡ɪ]

The data collection was conducted in an ongoing fashion from October 5, 2018 to June 13, 2019. The link to the survey was posted on Twitter, Facebook, and Instagram, and was subsequently shared by a number of "black twitter" *influencers*, including Gene Demby (a famous journalist who works for NPR's *CodeSwitch* broadcast and podcast), and the user @luckwman, whose tweet about the pragmatics of "the n-word" received 42,560 retweets and 58,669 likes. Ultimately, my pinned tweet with a link to the survey was seen 84,929 times (at the time of writing), with 776 people clicking on the link, and just over 200 ultimately participating in the study. Most of those participated in the three weeks following the initial tweet and retweets, and the initial posting on Facebook (which was shared by a well-connected actor). It is not clear how many of the 80,000 views were the target audience for participation in the study, however the end result was more than enough data to facilitate comparison with the ANAE. There were later waves of participation as various influential people retweeted the initial tweet weeks or months later.

While the exact details of how such a posting propagates through a social network like Twitter are opaque, as social media platforms keep their algorithms extremely well guarded, the end result is a sample of sufficient size from the desired target population. This sample was obtained without resorting to paying for a "promoted tweet."

Participants used their own microphones, and submitted audio only if and when they were satisfied with the recording they made. There were very few unusable files. The handful of submissions that were not usable fell into three categories: a silent 3 minute recording (the participant had not calibrated or given access to their microphone), recordings with extreme distortion, and recordings with excessive background noise (for instance, one recording in which the participant had a television playing the news in the background). There were fewer then ten such submissions. It should be noted that there is some evidence that microphone setup, especially on personal devices like phones and laptops can affect formant measurements slightly (Gold, 2009), however, the effect is much smaller than the effect sizes of interest when investigating regional variation in accents, and there is no reason to expect that the error in this sample introduced by variation in microphone type is not randomly distributed.

This suggests that this method – free, digital participation in a survey not performed through Amazon Mechanical Turk, but rather targeted at a different, specific audience – is potentially an effective method for future study. This is especially beneficial for spoken, not just written, sociolinguistic study.

JUNEBUG GOES TO THE BARBER

So here's the deal: Marcus is named after his dad, but everyone just calls him Junebug. Hes turning twelve this week. His momma stay watching him like a hawk. She's always asking him "where you going?"

But today, she's letting Junebug go to the barbershop by himself. That's probably cuz it's so near she can see him from down the street anyway.

He don't even care. He's just happy he can take care of getting a haircut. They're having a birthday cookout on Saturday and everyone's gonna be there. Everyone. that means the boys from school and the girls from school too ... so you know he's gotta look fresh. It's like his old man is always telling him: always come correct.

There's a lot of people outside when he leaves home. First he sees Miss Mary. She asks "how you doing lil man?"

"good."

Miss Mary is acting like she caught him misbehaving. "where you off to without your momma?"

"I'm just going to the shop."

"You must be feeling yourself. Out here struttin' around like you grown." Miss Mary always teases Marcus, but he knows she don't mean nothing by it.

He tells her "I'm finna be twelve. She said I can go by myself."

“Twelve?! Seems like yesterday you was just five! alright now big man, you take care of yourself. And tell your momma and them I say hi.”

“Yes ma’am.”

Next he runs into Mr. Robertson. He’s a musician. Hes’s practically a giant, but everyone calls him “Tiny.” Hess got a cart with him for his drums, and hes moving fast cuz he’s running late for a church gig. hes muttering to himself, talkin’ about, “Rev gon’ kill me!”

He plays jazz, so he was out late for a tribute to Barry Harris and he overslept. He’s been oversleeping more and more lately. “He gon’ be mad!”

Marcus asks “what happened?”

Tiny tells him: “What do you think? I overslept! now I gotta bring all these things to the church before the singers arrive!”

When Marcus gets to the shop, everyone is there. The regular corner boys are out front as usual. Junebug always sees the same barber. Everyone calls him Mac, even though his name is Terrence. Ain’t nobody foolish enough to call him terry, neither. Mac is out front talking to a brother with a beard.

Mac stops and bends down to dap Junebug up.

“You’re up next. You make a choice yet?” he says, pointing to the poster on the wall with different hair styles.

“Anything?”

“Yeah, anything.”

“Can I have a fade?”

“of course.”

“...but with three lines? pencil thin?”

“Where’s your momma at?” Mac knew Junebug’s mom and dad usually choose for him, and they don’t usually choose nothing that daring.

“She said I could come by myself.”

“Then you got it, big man.”

As Junebug sat down in the barber’s chair, he knew it was gonna be a good day.

4.2.2 Data Processing

One downside of this method is that it requires extensive processing after data collection and before analysis. For maximum comparability with the *Atlas of North American English*, the FAVE suite was used for forced alignment and vowel extraction (Rosenfelder et al., 2014).

The data processing pipeline was audio cleaning in the audio editing software Audacity; segmentation, alignment, and correction in the annotation and transcription software Elan (Brugman and Russel, 2004), forced alignment, normalization, and extraction using FAVE (Rosenfelder et al., 2014), and finally data analysis in the statistical software R (R Core Team, 2017) after joining the extracted audio data to the demographic survey and location data.

Each audio file was first read into Audacity. There, it was trimmed, as many speakers either started the recording before they were ready to read, ended it well after they had finished reading, or both. Next, noise reduction was performed. Then the audio was amplified (or reduced) as necessary. If the audio was clipped (usually due to a participant speaking too loudly to close to their microphone), clipping was fixed as best as possible using the ‘clip fix’ tool, however this was not strictly necessary, following advice from Mark

Liberman (p.c.). The resulting audio was then saved to file.

The new audio file was then read into Elan. It was segmented into breath groups, usually corresponding to individual sentences in the reading passage. Extraneous noises – laughter, heavy breathing, tongue clicks, and some false starts – were not included in the segments. Once it was segmented, the transcriptions were added line-by-line from the reading passage. When speakers diverged from the reading passage, the transcription was corrected to reflect what was said (this happened in most of the audio files, in minor ways, e.g., *he's* instead of *he* or *he is*). Transcriptions were also changed to account for uncorrected misreadings, such as *Miss Robinson* for *Mister Robertson*. Meta commentary was generally kept, and transcribed. For example, if a speaker misspoke, and then said "I can't believe I just said..." the comment was kept, as it reflects the speaker's natural vernacular. Transcriptions were also changed to reflect intentional changes that reflect how the speaker prefers to speak – most notably *everybody* was a common replacement for *everyone*. The transcriptions were saved as a .txt file, and the .eaf file produced by Elan was also saved to facilitate later changes if needed.

The .wav audio file and .txt were then force aligned using FAAValign.py in the FAVE suite, with a dictionary supplement that included words in the reading passage like "struttin'", "oversleeping", and "Junebug". The resulting files were processed with extractFormants.py, and the .TextGrid and .txt files were all saved.

Finally, the audio data were read into R, and joined with the survey demographic data, where they could be grouped, graphed, mapped, etc.

4.2.3 Data Analysis

Analysis in R was extensive, and consisted of multiple parts, including joining the demographic data to a spatial data frame, creating new variables (including splitting vowel measurements into various conditions, such as "preceding a nasal segment"), obtaining

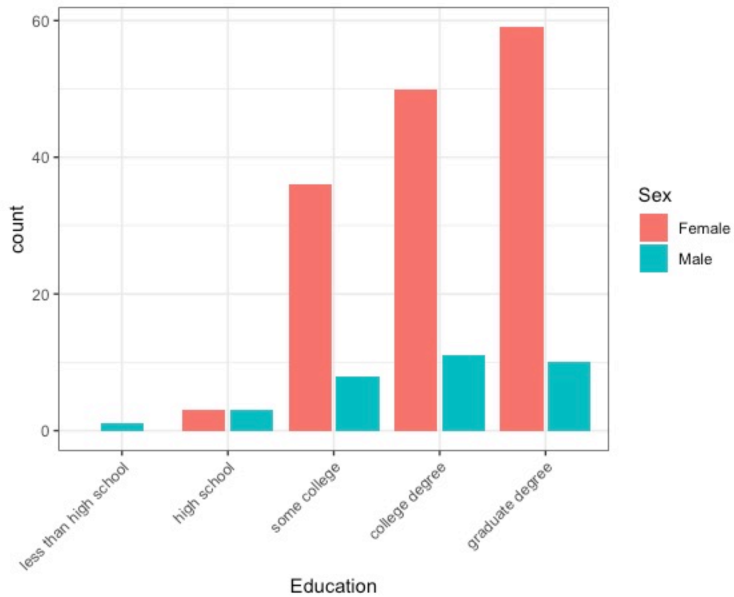


Figure 4.1: Distribution of education level in the AAE sample

summary statistics on the demographic data, investigating mergers, performing Gi* analysis, performing cluster analysis, and mapping the findings.

Exploratory data analysis was performed in part using two Shiny apps in R: one to analyze vowel plots and another to extract and map audio.

Demographics of respondents

The sample studied here is not a balanced sample, and care should be taken in interpreting the results. There is a proponderance of college graduates in these data (figure 4.1), suggesting estimates are biased toward middle class, educated, white norms. Given that the topic of interest is variation in AAE and divergence from white norms, however, a conservative estimate is better. As will be shown below, even in these data, there are strong patterns of regional variation that do not align with the ANAE.

Similarly, there is a preponderance of women, and a skew toward younger participants (figure 4.2). This is ideal for comparison with the ANAE, which intentionally sought to

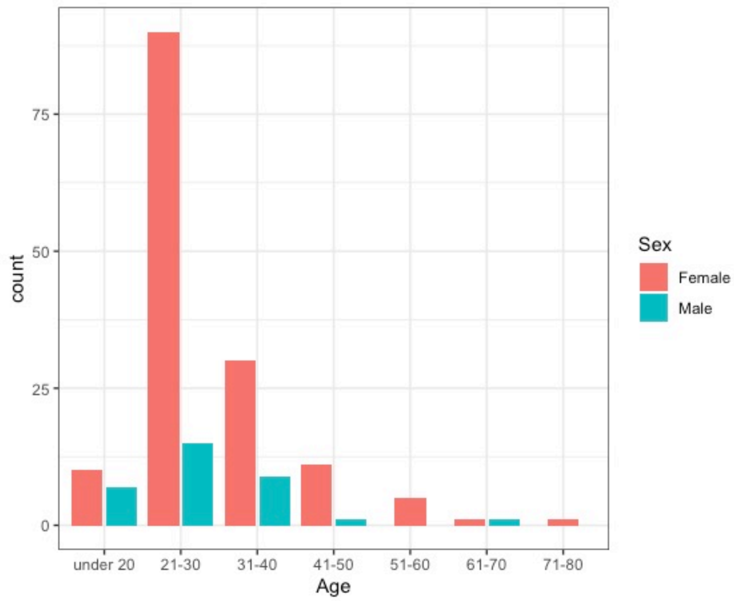


Figure 4.2: Distribution of age and sex in the AAE sample

survey young women, as they are assumed to be the leaders of linguistic change (Labov, 1994; Labov et al., 2005).

For all of the ensuing discussion, it is important to bear in mind that the measure of AAE divergence and regional differentiation is likely a highly conservative one, and that there is likely much greater variation than measured here, especially among working and lower-middle class speakers.

Monophthongization of /ay/

Monophthongization of /ay/ plays a central role in the ANAE, as unconditional monophthongization of /ay/ is taken to be the main triggering event that led to the Southern Vowel Shift. African American English, however, is generally described as exhibiting diphthongal /ay/ before voiceless consonants (following Labov's notation, in the /ayC/ or /ay0/ condition), and monophthongal elsewhere (Fridland, 2003). That is, we would expect monophthongization in words like *I* and *time*, but diphthongal quality in words like *night* and *bike*.

Monophthongization of /ay/ is therefore expected to be a conditioned change in AAE, and one that does not bear on the proposed African American Vowel Shift.

For the analysis performed in the ANAE, whether a pronunciation was monophthongal or diphthongal was determined auditorily by the researchers. In the interest of eliminating researcher bias, here I introduce a new method of analysis of monophthongization, building on the methods used in Carmen Fought's dissertation (Fought, 1997). The procedure relies on using more information from the acoustic signal than traditionally used by sociolinguists, and performing dimension reduction and scaling to create a single parameter for each speaker measuring mean monophthongization of /ay/.

The procedure was as follows: I first measured the Mel Frequency Cepstral Coefficients for all vowels for all speakers at 20% of the vowel duration, 50% of the vowel duration, and 80% of the vowel duration. I then used all of the observations to create a covariance matrix to use in evaluating mahalanobis distances in a later step. I then performed principal components analysis (PCA) for dimension reduction, reducing my 12 MFCC space to a 3 dimensional space. For each speaker, I then:

1 selected all tokens of /iy/ and /o/ at 80% of the vowel duration. These represent the extreme ends of diphthongal character and monophthongal character of /ay/, respectively.

2 selected all instances of /ay/ at 80% of the vowel duration.

3 found the means of the distributions of /iy/ and /o/.

4 centered the mean of /iy/ at the origin.

5 solved for the necessary rotation matrices to keep the mean of /iy/ at the origin and rotate the entire distribution such that the mean of /o/ sat along the x-axis.

6 projected all observations of /ay/ onto the line between the means of /iy/ and /o/.

7 scaled the data.

The result was, for each speaker, a single parameter from zero to one (although not technically bounded by these points) that measured total, extreme diphthongal character of /ay/, ending in the center of the distribution of /iy/ (normally, diphthongal /ay/ raises only about to /i/, hence the IPA notation of /ɑ͡ɪ/), to total, extreme monophthongization, near the center of the distribution of that speaker's /o/ vowel class.

I then found the mean monophthongization by vowel class – whether followed by a voiceless consonant or not – and saved this measure for each speaker.

The results are broadly consistent with the existing literature on AAE: the majority of speakers exhibit greater monophthongization of /ay/ when not preceding a voiceless consonant. Figure 4.2.3 shows monophthongization score for /ay/ and /ayC/ conditions matched by speaker. In this figure, zero on the y-axis corresponds to the mean location of /iy/ at 80% of its duration. 0.5 corresponds to the mean of /i/, and therefore to a normally realized fully diphthongal /ay/. 1.0 on the y-axis corresponds to the mean of /ah/, and therefore to a fully monophthongized realization of /ay/, in which the vowel at 80% of its duration has not moved from the starting point of /ah/ toward /i/. Since 1 corresponds to fully monophthongized, and 0.5 corresponds to a fully diphthongal realization, 0.75 is marked with a dashed line, as a simple decision boundary at the midpoint between diphthong and monophthong realizations.

The general downward slope of the matching lines is consistent with greater overall diphthongal character in the /ayC/ condition. However, note that for some speakers there seems to be similar or *greater* monophthongization of /ay/ in the /ayC/ condition. This is consistent with unconditional monophthongization of /ay/. This phenomenon has been described for AAE speakers in Detroit (Anderson, 2002), which is precisely where we see this phenomenon in the data (see section 4.2.6).

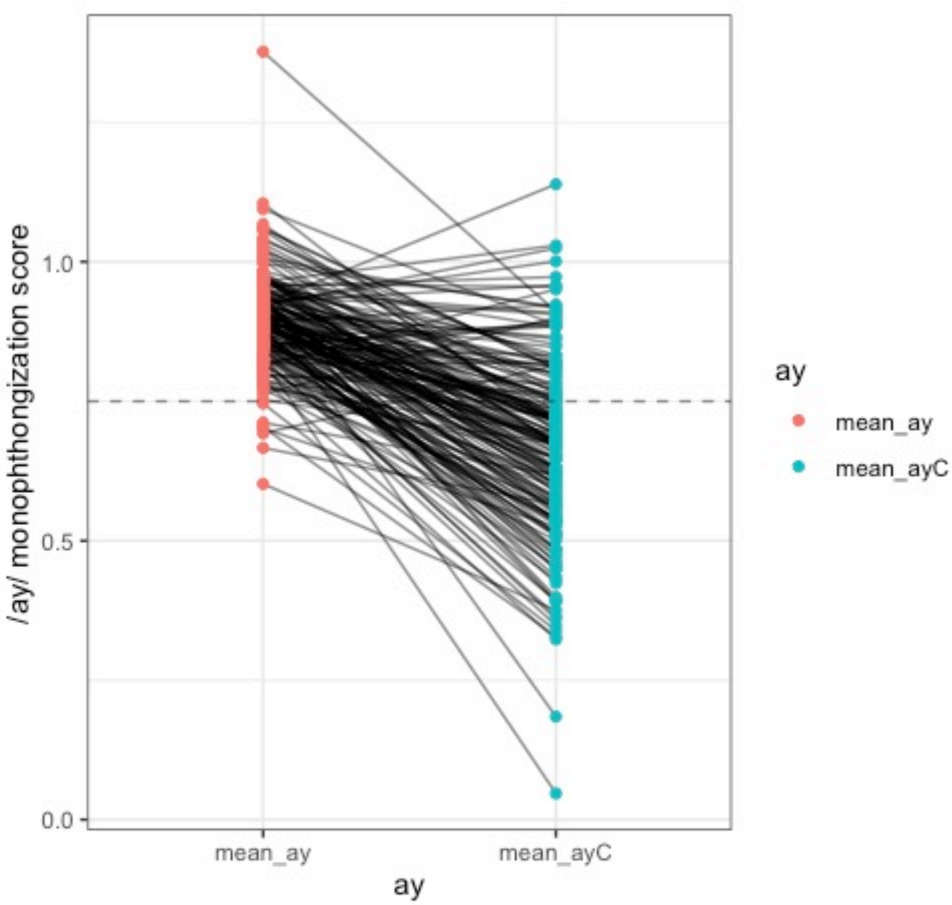


Figure 4.3: /ay/ monophthongization score by condition, matched by speaker

Mergers

African American English is generally characterized as exhibiting a number of conditioned vowel mergers and shifts, most famously the PIN-PEN merger, in which the non-peripheral front vowels /i/ and /e/ are merged before nasals, but also the FEEL-FILL, merger, and a shift of /i/ before velar nasals to /ey/, as in 'it ain't no *thang*.'

There are a handful of generally accepted best practices in measuring vocalic mergers, discussed by Nycz and Hall-Lew (2013), including the now-standard approach in sociolinguistics of utilizing the Pillai-bartlett Trace (or "Pillai Score") to evaluate merger. Here, I chose to use the standard Pillai Score to investigate mergers.

The Pillai score, or Pillai-Bartlett trace, was introduced for sociophonetic research by Hay et al. (2006) and quickly adopted as a "best practice" in sociophonetics Nycz and Hall-Lew (2013). As Nycz & Hall-Lew explain, the Pillai score

> [...] is simply a statistic that is part of the output of a MANOVA model [...] Multivariate analysis of variance (MANOVA) is a type of ANOVA that models variation with respect to more than one dependent variable simultaneously, such as both F1 and F2. The higher the value of the Pillai statistic, the greater the difference between the two distributions with respect to these dependent variables. Each model also provides a measure of statistical significance, with a p-value generated for each Pillai statistic that indicates whether the difference between clusters is significant.

For this study, I generated a Pillai score and p-value for each vowel and condition of interest (e.g., /i/ and /e/ before nasals). As with other measures, the Pillai score and p-values were mapped, and Gi* hotspot analysis was performed and those results mapped as well.

4.2.4 Kriging Alone

As with the ANAE data in the previous chapter, kriging was used to interpolate values.[3] However, unlike with the ANAE data, not all of the vowels in the AAE data exhibited sufficient spatial structure to allow for kriging. This is to be expected for a few reasons. In fact, it is surprising that the raw data for the ANAE exhibited such dramatic spatial structure. The first reason is that the sample is a smaller sample than the ANAE data. More important than that, however, is the fact that the Great Migration ended in the early 1970s, less than fifty years ago, and contemporaneous accounts suggest AAE exhibited little to no regional variation at that time – AAE speakers in Detroit and New York are reported to sound alike, and like AAE speakers in the South. This is unsurprising, given that most speakers in the North at that time had parents or grandparents from the South, and until 1794 residential segregation, red-lining, and blockbusting were legal and encouraged, meaning AAE speakers in northern cities effectively lived in bubbles of southern AAE where they were not exposed to other local varieties much if at all. In fact, this segregation persists in most northern cities, despite ostensible efforts to reduce residential and educational segregation (Denton, 1995; Kohli, 2014; Stancil, 2018). The problem of insufficient spatial structure for kriging disappears after the application of the Getis-Ord Gi* statistic, below (section 4.2.5). The vowels that exhibited sufficient spatial covariance structure to allow for kriging were:

- F1 of /i/ (KIT)
- F1 of /ey/ (FACE)
- F1 of /e/ (DRESS)
- F1 of /ow/ (GOAT)

[3] Interpolation was continuous, however in the interest of readability and processing speed, the value at the centroid of each county was used to generate a value for each county. For this reason, in the final maps, superimposed points may not share the exact same value as the county they are in.

- F1 of /oh/ (THOUGHT)
- F2 of /aw/ (MOUTH)
- F2 of /ʌ/ (STRUT)

The other formant measurements did not exhibit sufficient spatial structure to allow for kriging in their raw form. The vowel and formant combinations above stand out as being the formants implicated in the proposed African American Vowel Shift, excepting movement of /æ/, which it will be shown exhibits complicated spatial structure in two dimensions that a single dimension (that is, F1 or F2 alone) cannot capture. The vowel measurements not implicated in the AAVS are those implicated in the Back Upgliding Shift (the height of /oh/ and frontness of /aw/).

In addition, the p-values for the Pillai Score for /i/ and /e/ before nasals – investigating the PIN-PEN merger – and the /ay/ monophthongization scores exhibited sufficient spatial structure to allow for kriging.

Interpolated values are very robust for the South, Midwest, Northern cities, mid-Atlantic region, and East Coast up to New York, as well as California and the West Coast, however estimates in the inland West should not be over-interpreted: they are the best interpolations given the data, however there is negligible black population in most of those counties, and so any statement of what AAE is like in those areas should be taken with a grain of salt (see figure 4.4).

These maps should be interpreted with extreme caution, as it is better to evaluate against the Getis-Ord Gi* transformed data, however the kriged maps of the raw data will give an idea of the general range of values in the raw data. For instance, F1 of /i/ exhibits strong regional structure, however, the range of values is only about 30Hz (figure 4.5). This is above the threshold for auditory perception – that is, it is noticeable to a trained linguist – but it is not as dramatic as, say, the range of values for the F1 of/æ/ in European American

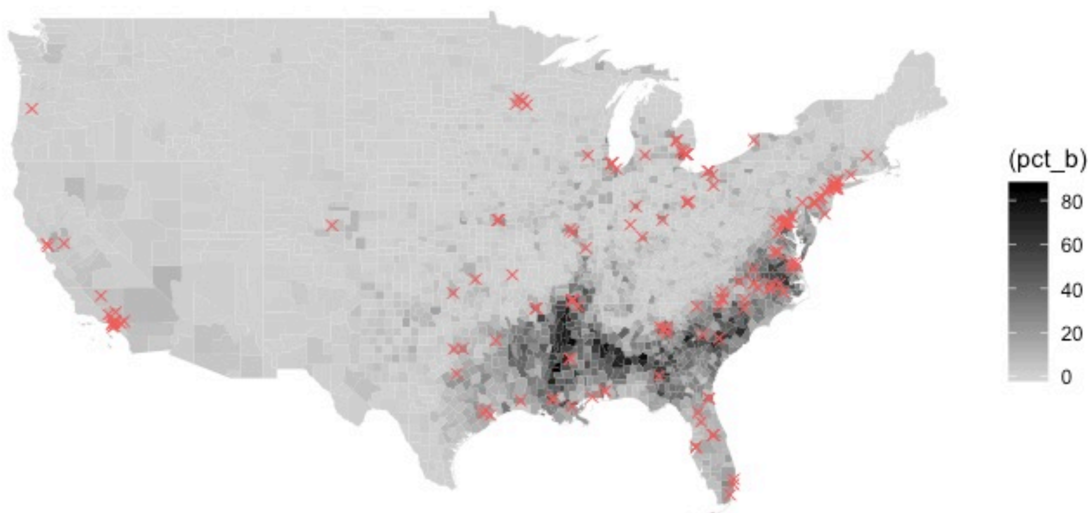


Figure 4.4: Participant locations over percent Black population

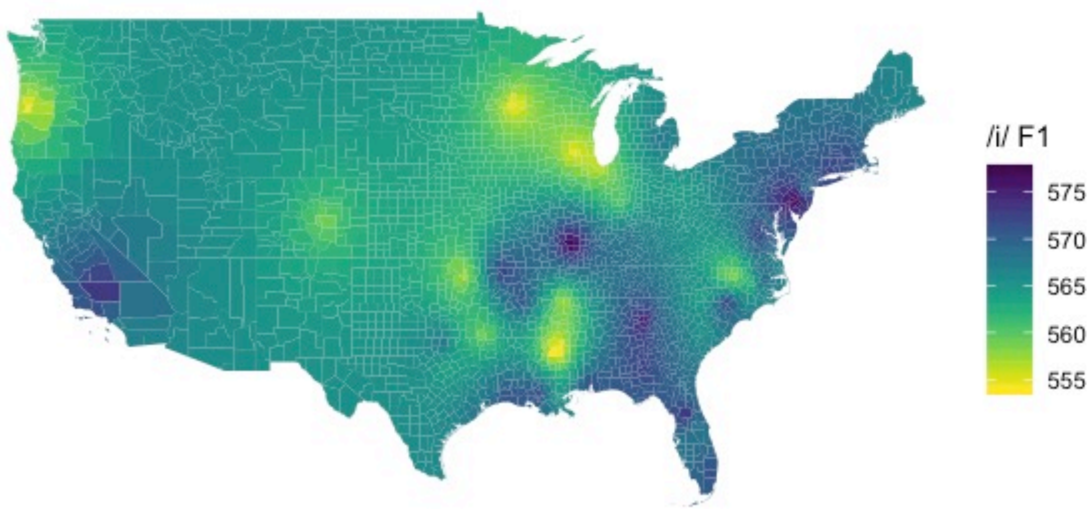


Figure 4.5: F1 of /i/ (kriged)

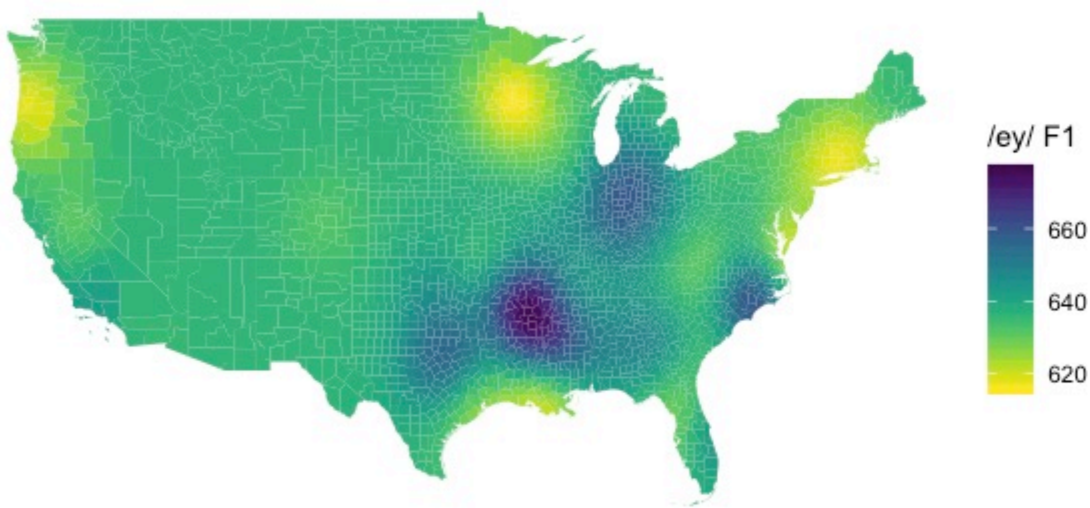


Figure 4.6: F1 of /ey/ (kriged)

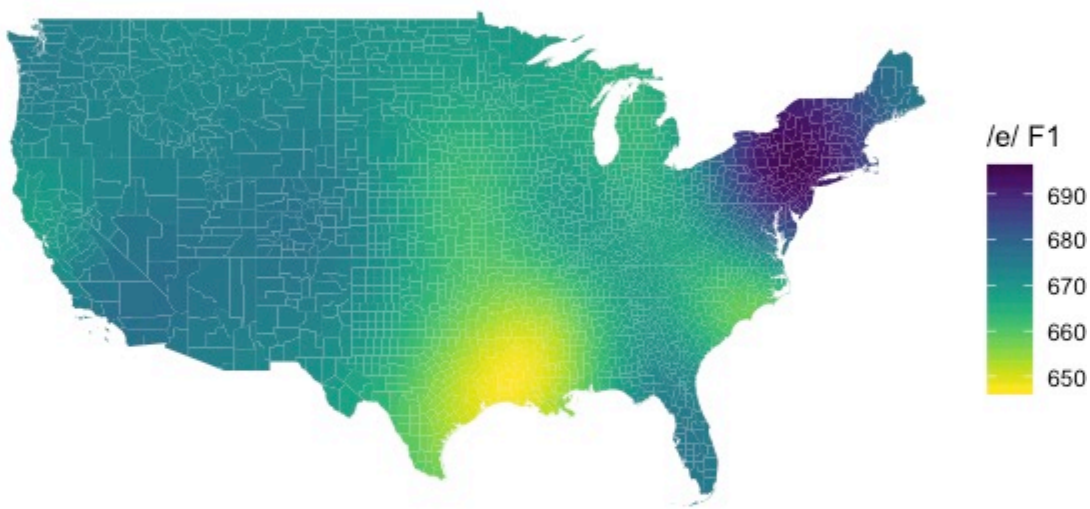


Figure 4.7: F1 of /e/ (kriged)

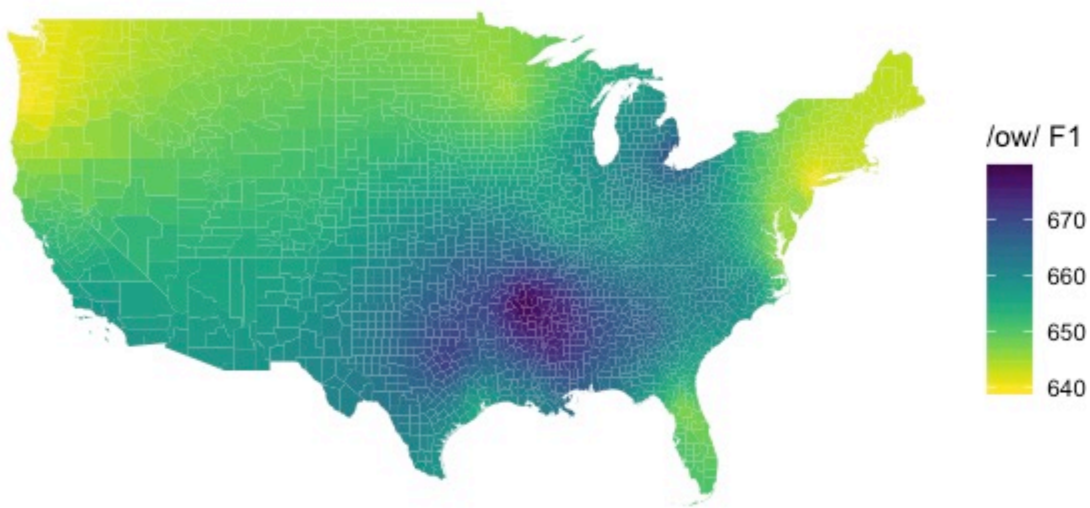


Figure 4.8: F1 of /ow/ (kriged)

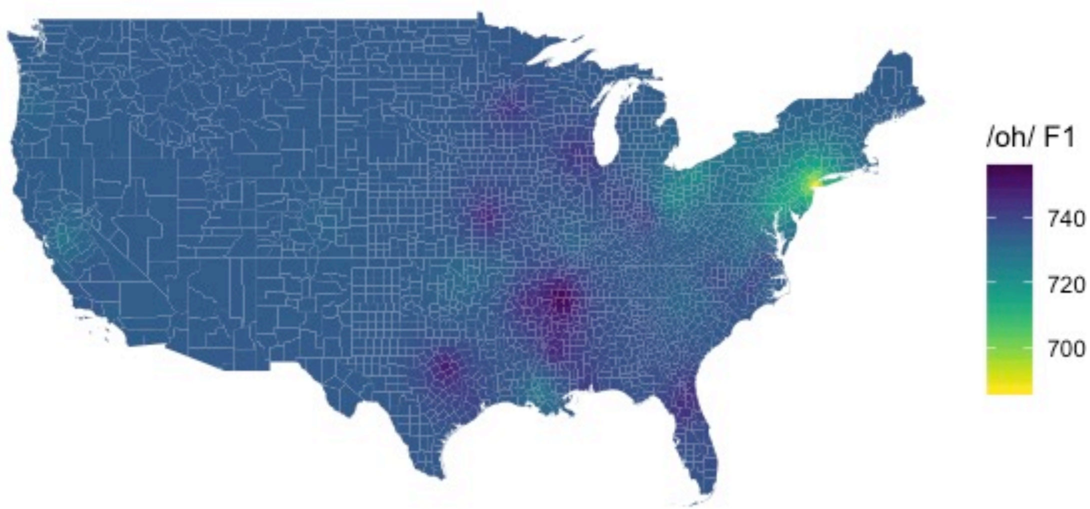


Figure 4.9: F1 of /oh/ (kriged)

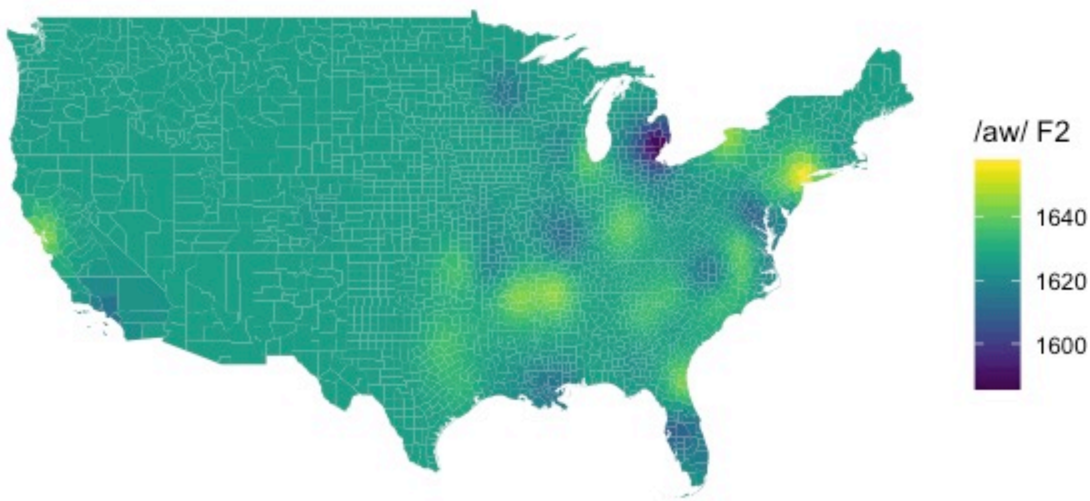


Figure 4.10: F2 of /aw/ (kriged)

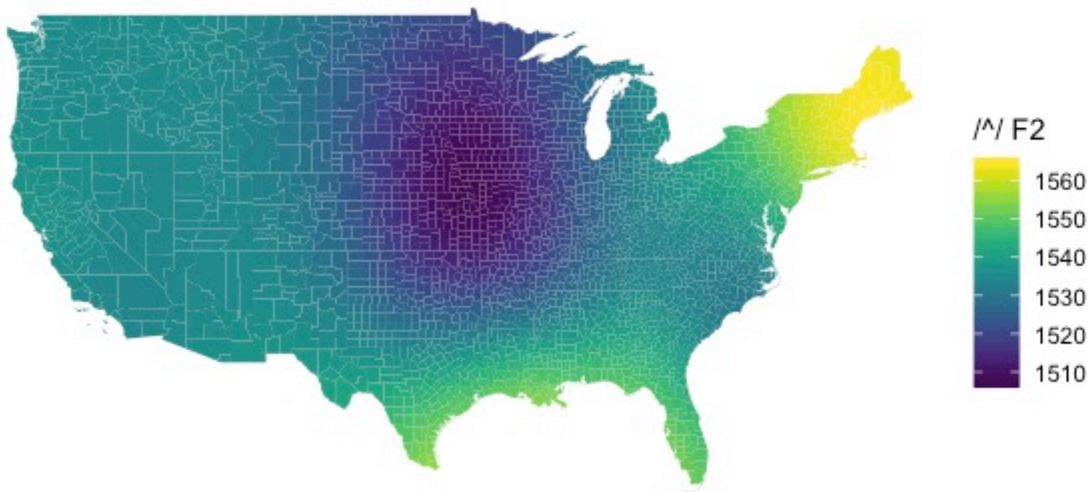


Figure 4.11: F2 of /ʌ/ (kriged)

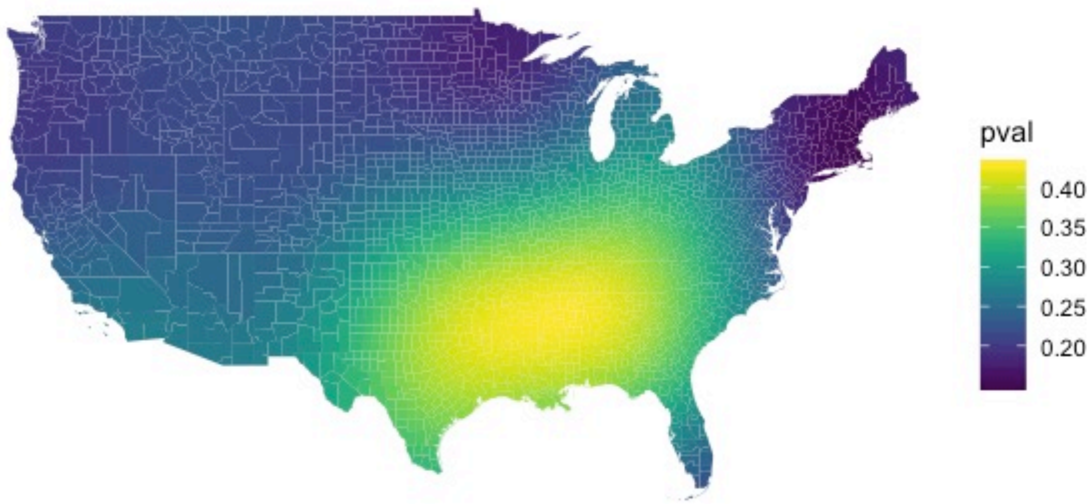


Figure 4.12: P-values for the Pillai score for /i/ and /e/ before nasals (kriged)

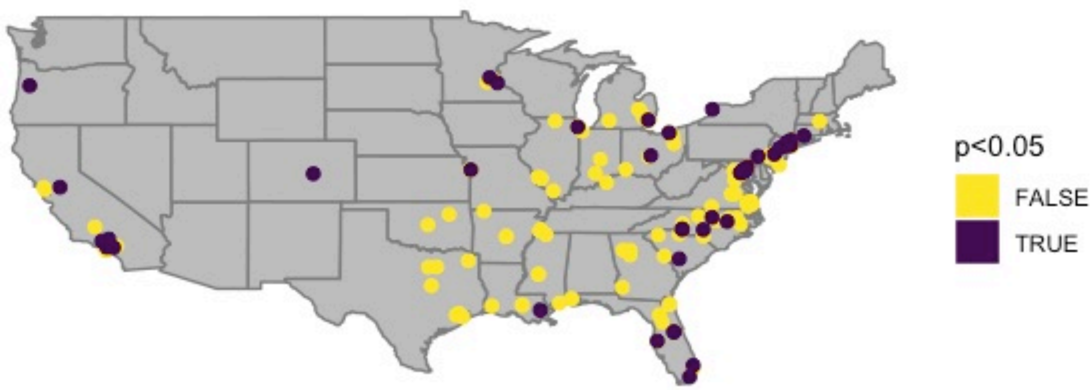


Figure 4.13: P-values for the Pillai score for /i/ and /e/ before nasals. Purple are $p < 0.05$, indicating fully distinct vowel classes

Englishes. The first formant of /i/ as in KIT is noticeably lower, meaning the vowel is noticeably higher, in a band moving up the western side of the Mississippi, from Louisiana to Chicago and Milwaukee. The vowel is also noticeably higher in parts of North Carolina and in Seattle (although for this latter location, there is insufficient data to make a strong claim about AAE in the Pacific Northwest).

The vowel /ey/ as in FACE is relatively high along the East Coast, near Minneapolis, around Seattle, and in parts of the Gulf, however the more interesting pattern is the significant lowering of /ey/ around Arkansas and Missouri, Illinois and Indiana, and South Carolina (figure 4.6). This lowering of /ey/ is also one of the elements of the proposed African American Vowel Shift.

The raising of /e/ as in DRESS is most strongly apparent in the Gulf states, especially Texas and Louisiana, and moving upward from Louisiana into Arkansas and Missouri, but continuing to some degree all the way up to Minnesota and Wisconsin (figure 4.7). It is also present in North Carolina. Raising of /e/ is strongly resisted in the Northeast, especially in New York, leading to a range of values of roughly 70Hz.

The first formant of /ow/ as in GOAT is relatively lowered along the same corridor moving up from Louisiana, through Arkansas and Missouri, with a difference in values of roughly 40Hz (figure 4.8). New York City and Washington State exhibit the strongest raising of /ow/.

The second formant of /oh/ as in THOUGHT exhibits a strong regional pattern, with New York City AAE speakers employing the stereotypical New York [ʊ͡ɔ] or [u͡ɔ], and with the western side of the Mississippi, from Louisiana, again up through Arkansas and Missouri, up to Chicago and Milwaukee exhibiting fronting and lowering of the nucleus of /oh/ to something like [æ͡ɔ] or [æ͡o] (figure 4.9).

The vowel /aw/ as in MOUTH is more relatively front in New York City and relatively back in Detroit, with less meaningful spatial variation outside of these two cities (figure 4.10).

The second formant of /ʌ/ exhibits strong, supraregional variation. It is relatively fronter in the Northeast from New York through Boston, and relatively backer west of the Mississippi and north of the Gulf (figure 4.11).

Examining the kriged p-values for the Pillai statistic applied to /i/ and /e/ before nasals (that is, investigating the PIN-PEN merger), it is clear there is a strong geographic pattern. The way the Pillai statistic is usually employed in sociolinguistic studies, we would consider a p-value of less than 0.05 to be indicative of completely distinct vowel classes. However, this statistic can be interpreted in a much more gradient manner – it would not be wise to say that a p-value of 0.051 indicates that the speaker has a vocalic merger! Looking at the p-value as a statistical measure of the degree of merger, we can see that speakers in New York and Northern California do not reliably exhibit the PIN-PEN merger, as has already been attested in the literature (figures 4.12 and 4.13) (see King 2016 discussing Palo Alto, King 2018 with regards to Rochester, and Jones et al. 2019 discussing New York and Philadelphia).

4.2.5 Gi* Hotspot Analysis

Because the data from the AAE survey were geographically sparser than the ANAE, and because there were not as many points sampled from the same location as in the ANAE, 25 nearest neighbors was an inappropriately high number of neighbors for Gi* analysis with these data. However, as with the ANAE, many cities and metropolitan areas with high population had multiple samples – For instance, there were 2 speakers from the Bronx, and 8 speakers from New York City as a whole. Because of this, 5 or 10 nearest neighbors was an inappropriately low number. Therefore, 15 nearest neighbors were used.

Here, I present maps of the point observations first, before smoothed, interpolated maps in section 4.2.6. The maps in this section give the most precise and honest picture of regional variation in the sample. The subsequent smoothed maps can aid visualization and assist

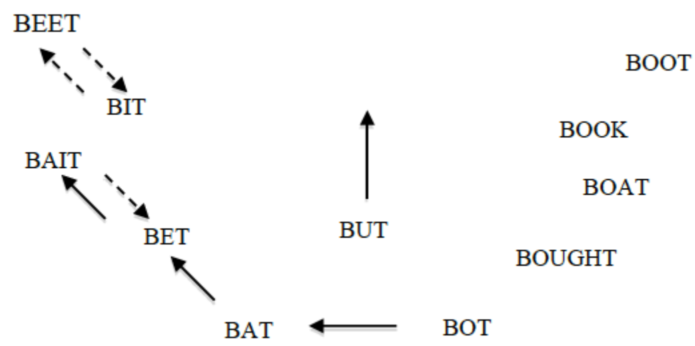


Figure 4.14: The AAVS (after King 2016)

interpretation, but should not be over interpreted.

The AAVS

The AAE survey data provides strong support for the existence of the African American Vowel Shift (AAVS, figure 4.14), however it also provides strong evidence that the AAVS is much more regionally constrained than previously suggested. The AAVS was proposed and described primarily by researchers from North Carolina State University, doing fieldwork in the Piedmont region of the Carolinas, and indeed, what we find is that the AAVS is most strongly present in the Piedmont region of the Carolinas. There is further evidence for elements of the shift along the corridors of the Great Migration west of the Mississippi, so it does appear to be supra-regional in character – however there is very little evidence for the AAVS in the Northeast, which is consistent with descriptions of AAE from Washington D.C. to Boston in the literature. The AAVS is characterized by fronting of fronting of /ah/ as in PALM, fronting and raising of /æ/ as in TRAP, raising of /ʌ/ as in STRUT, raising of the nucleus of /ey/ as in FACE, and possible reversal of both /ey/ and /e/ and /iy/ and /i/ (stages 2 and 3 of the Southern Vowel Shift).

Starting with the lowering of /iy/ as in FLEECE, it is most apparent in inland North Carolina, but also present to a lesser extent in parts of the Gulf (figure 4.15). It is most

Figure 4.15: F1 of /iy/ Gi* with 15NN

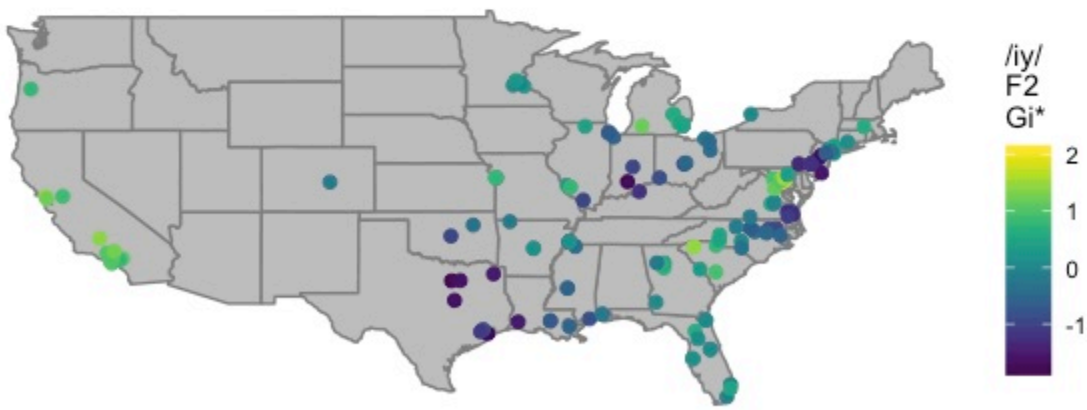


Figure 4.16: F2 of /iy/ Gi* with 15NN

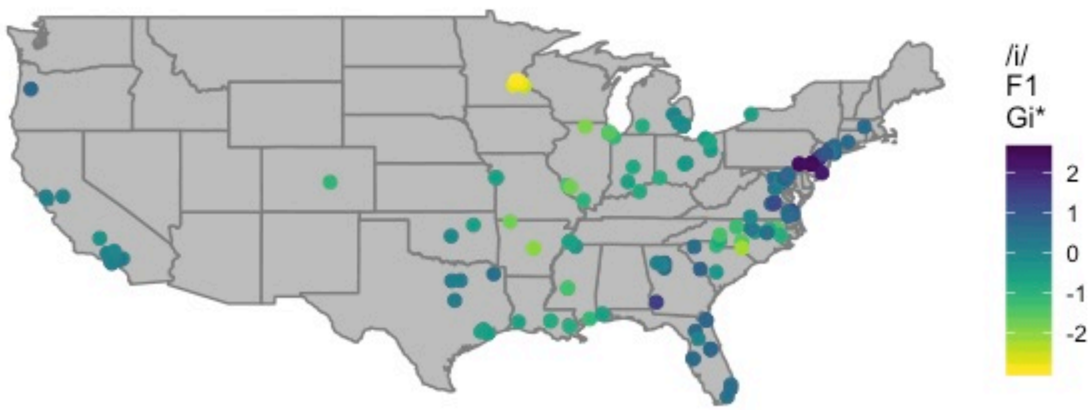


Figure 4.17: F1 of /i/ Gi* with 15NN

Figure 4.18: F2 of /i/ Gi* with 15NN

Figure 4.19: F1 of /ey/ Gi* with 15NN

Figure 4.20: F2 of /ey/ Gi* with 15NN

Figure 4.21: Stage 2 of the SVS (reversal of /ey/ and /e/) in AAE, Gi* with 15NN

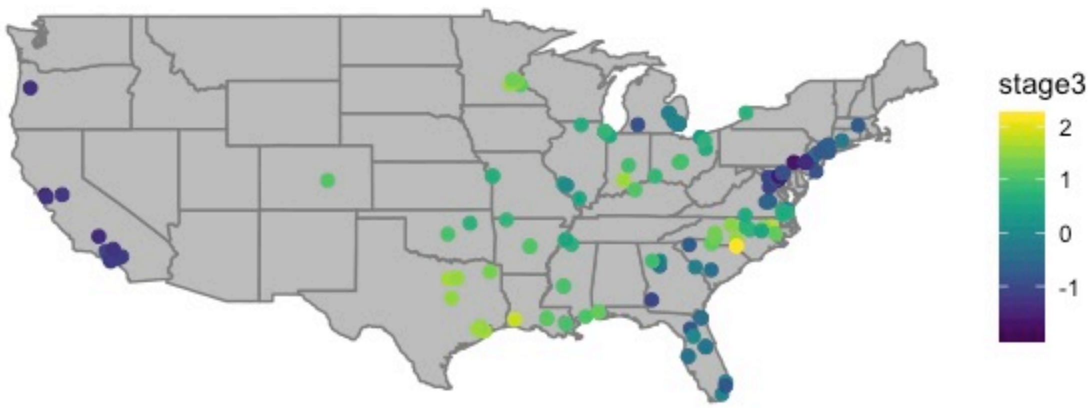


Figure 4.22: Stage 3 of the SVS (reversal of /iy/ and /i/) in AAE, Gi* with 15NN

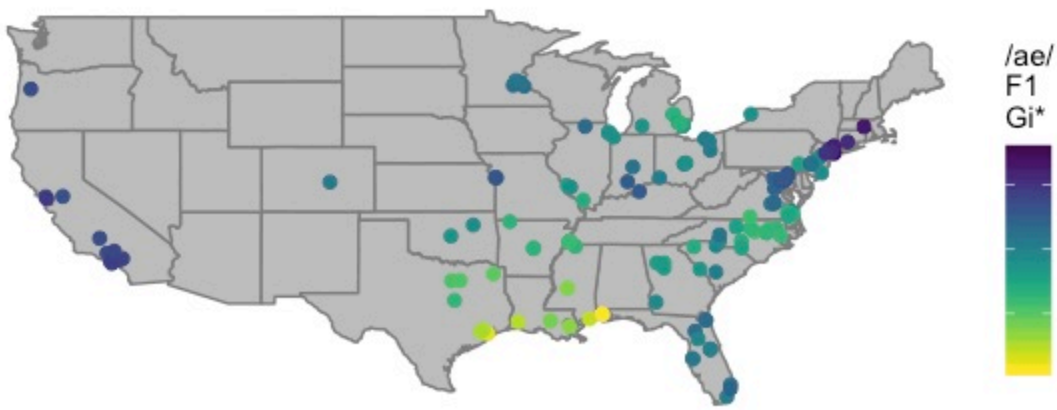


Figure 4.23: F1 of /ae/ Gi* with 15NN

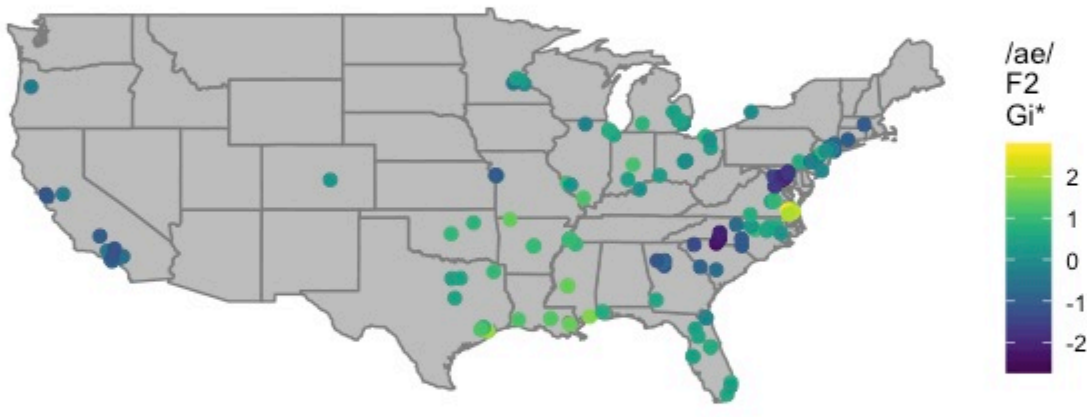


Figure 4.24: F2 of /ae/ Gi* with 15NN

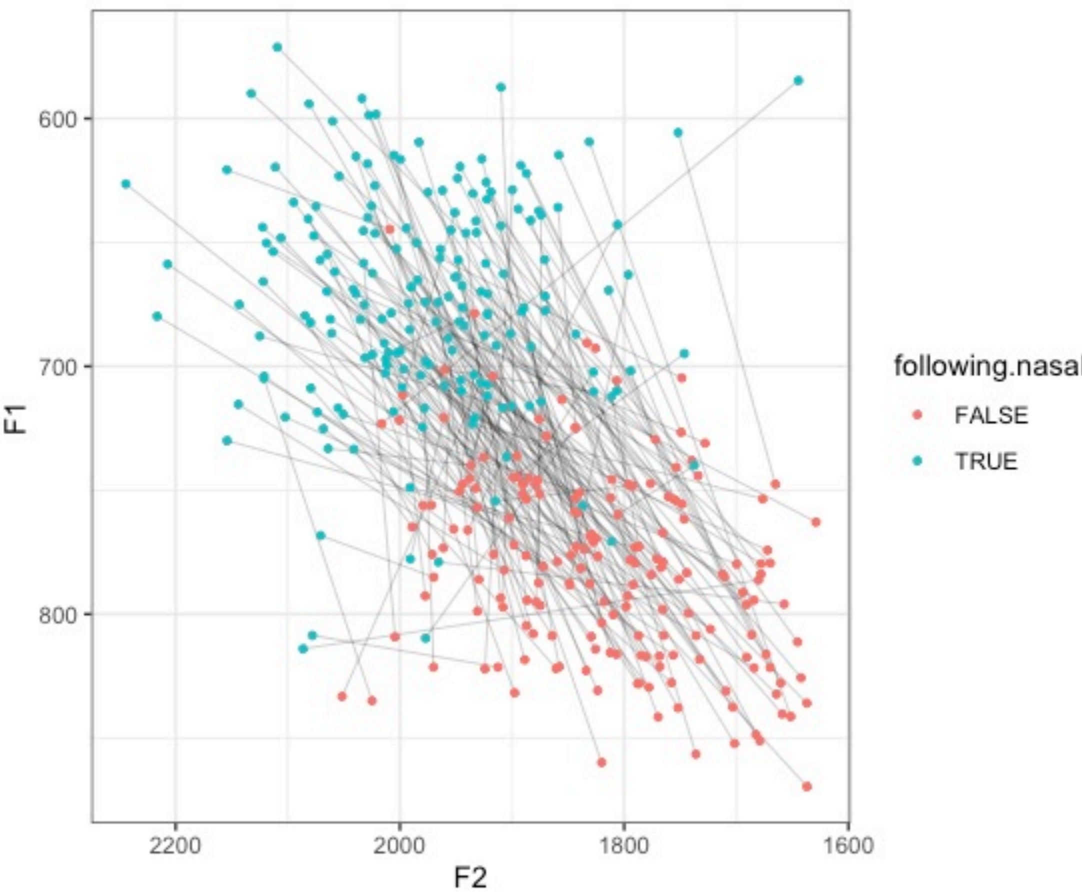


Figure 4.25: Mean F1 and F2 of /æ/ by speaker. Observations in blue precede a nasal consonant, observations in red do not.

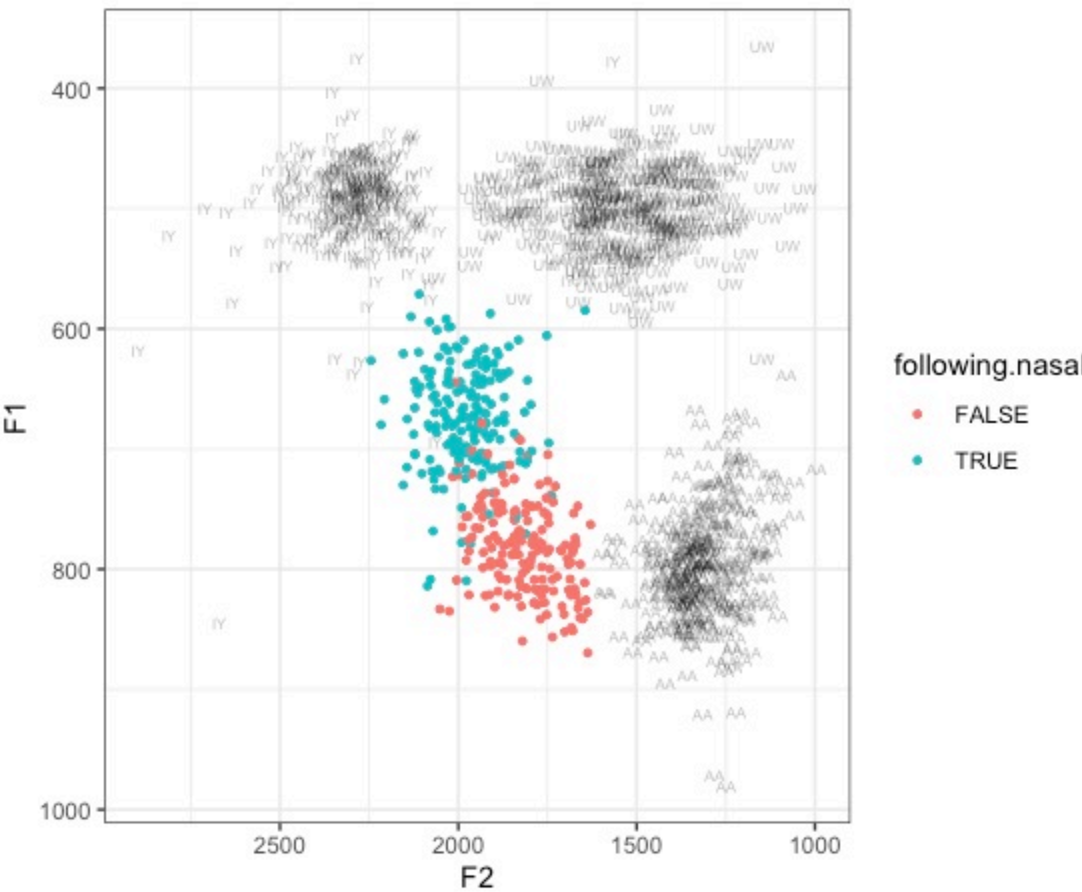


Figure 4.26: Mean F1 and F2 of /æ/ by speaker. Observations in blue precede a nasal consonant, observations in red do not. /AA/ represents /a/ and /ah/ in Labovian notation.

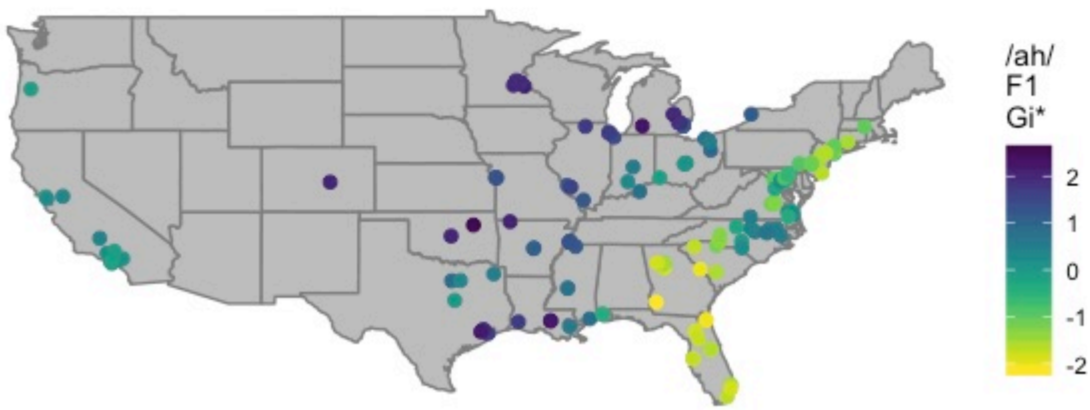


Figure 4.27: F1 of /ah/ Gi* with 15NN

Figure 4.28: F2 of /ah/ Gi* with 15NN

Figure 4.29: F1 of /ʌ/ Gi* with 15NN

Figure 4.30: F2 of /ʌ/ Gi* with 15NN

Figure 4.31: The AAVS (all maps superimposed)

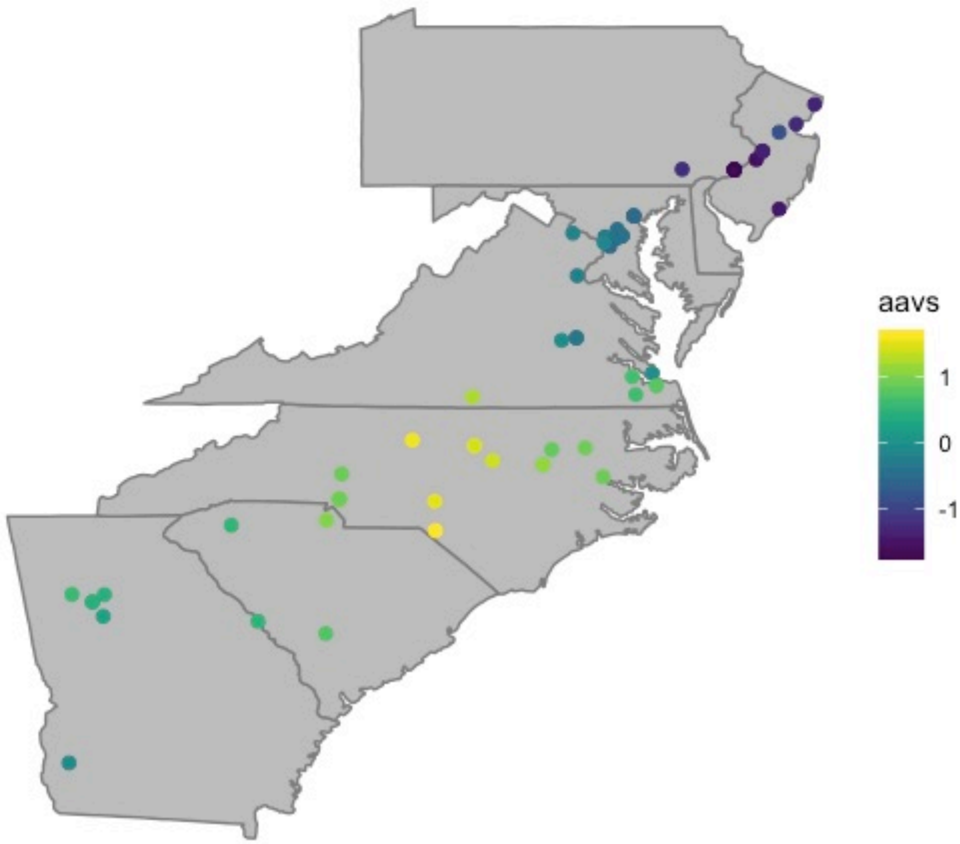


Figure 4.32: The AAVS in North Carolina (all maps superimposed)

clearly resisted in Philadelphia, and Kalamazoo. As with all of the maps in this section, some of the pattern will become clearer in section 4.2.6.

The second formant of /iy/ shows backing west of the Mississippi, especially in Texas and Louisiana, as well as in Illinois, Indiana, and Ohio, and around Philadelphia (figure 4.16).

The lowering of /i/ is not universally present, and is strongly resisted around Philadelphia both up through New York and Boston and down through Washington D.C. (figure 4.17). It appears lowest in a path following the Mississippi river, up from Louisiana through Minnesota, but also as far east as Ohio.

Similarly, /i/ is fronted in the middle of the country, but this fronting is most clearly resisted in both the Northeast from Washington D.C. to Boston, and along the West Coast (figure 4.18).

Using the same measure as the ANAE uses for stages 2 and 3 of the Southern Vowel Shift – that is, F1 of /e/ $<$ F1 of /ey/ and F2 of /e/ $>$ F2 of /ey/ for stage 2 and F1 of /i/ $<$ F1 of /iy/ and F2 of /i/ $>$ F2 of /iy/ for stage 3 – it is clear that these shifts are present in AAE (figures 4.21 and 4.22). However, as will become even clearer in the next section, these shifts are not geographically coterminous with the same shift in Southern (European) American English. Rather, the reversal of /ey/ and /e/ is most pronounced west of the Mississippi as far west as east Texas, in a pattern moving northward up from Texas and Louisiana through Arkansas, eastern Oklahoma, Missouri, and Illinois, with some lesser evidence for the shift in Illinois, Indiana, and Ohio. It is also present in inland North Carolina. It is strongly resisted in the Northeast. The reversal of /iy/ and /i/ follows a similar pattern, albeit less strongly (as is to be expected, since this shift is expected to follow the reversal of /ey/ and /e/). It is relatively diffuse compared to the the reversal of /ey/ and /e/, suggesting the possibility that the first reversal was in progress during the Great Migration, and the reversal of /iy/ and /i/ is following naturally, but in a more geographically diffuse area. Note, also, that it is once again present in inland North Carolina, and strongly resisted in the Northeast.

Figure 4.23 shows the F1 of /æ/ as in TRAP, which is most raised in the Gulf states, and lowest in California and in the Northeast, especially in New York and parts north. The variation in realizations of /æ/ in the AAE data were complex, and not unidirectional (see figure 4.94, below). A key distinction between the AAE data and the ANAE data is that while a following nasal does correspond to a raised nucleus of /æ/ in the AAE data, it is nowhere near as extreme as in the ANAE data (figures 4.25 and 4.26). Contrary to the AAVS, and in keeping with King (2016), /æ/ in California exhibits so-called TRAP-backing, moving toward /a/.

In this sample, /a/ and /ah/ are relatively higher in the Florida panhandle and in Georgia, and up through the East Coast, and relatively lower west of the Mississippi from the Gulf to the Great Lakes. As with other vowels above, this western pattern is mirrored in inland North Carolina (figure 4.27).

Lastly, wedge is raised in the Southeast, from the Gulf to the Great Lakes along the western side of the Mississippi, with the greatest raising around St. Louis (figure 4.29). Along the same areas, wedge is relatively backed (figure 4.30), so the vowel in *bug* as in *Junebug* is in some cases indistinguishable from the vowel in *book*.

The AAVS clearly has some support in these data, although it is not as universal in character as has been claimed in the literature (Kohn and Farrington, 2013; Thomas, 2007; Yaeger-Dror and Thomas, 2010). Much of the research on the AAVS was performed by researchers working out of North Carolina State University, and in fact, what is perhaps most striking about the AAVS is that it characterizes a broad region moving northward from the Gulf States *and* inland North Carolina, approaching the Piedmont region, where most of the field work performed by NCSU researchers was executed (figure 4.32). This pattern will be discussed further below, following the maps in section 4.2.6.

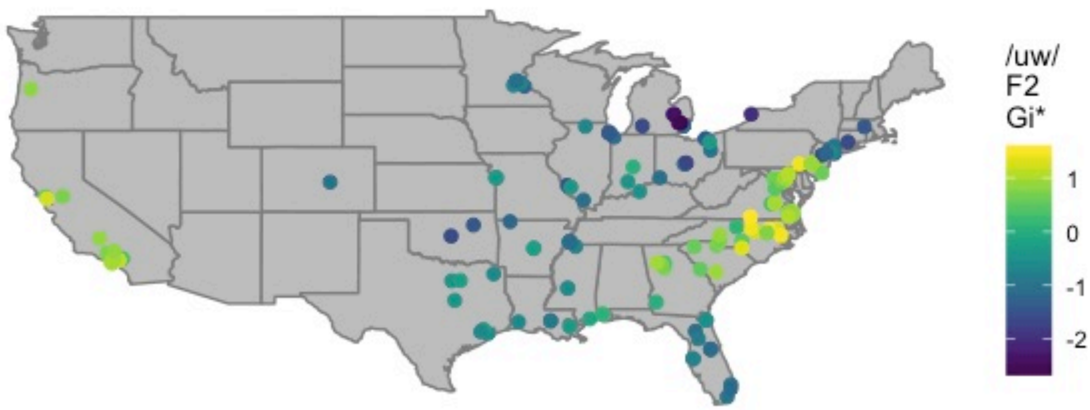


Figure 4.33: F2 of /uw/ Gi* with 15NN

Fronting of Back Vowels

The fronting of the back vowels /uw/ as in GOOSE and /ow/ as in GOAT has not historically been a topic of discussion in the literature on AAE, until recent work on AAE in Washington D.C. by researchers affiliated with the Corpus of Regional African American Language (CORAAL) and with Georgetown University (Annon, 2016; Arnson and Farrington, 2017; Farrington and Schilling, 2019; Lee, 2016). Much of the discussion of fronting of back vowels treats this phenomenon as one of accommodation to local white norms in the mid-Atlantic region. However, from these data, a more nuanced picture emerges.

The high back vowel /uw/ fronts along the entirety of the mid-Atlantic region, but it

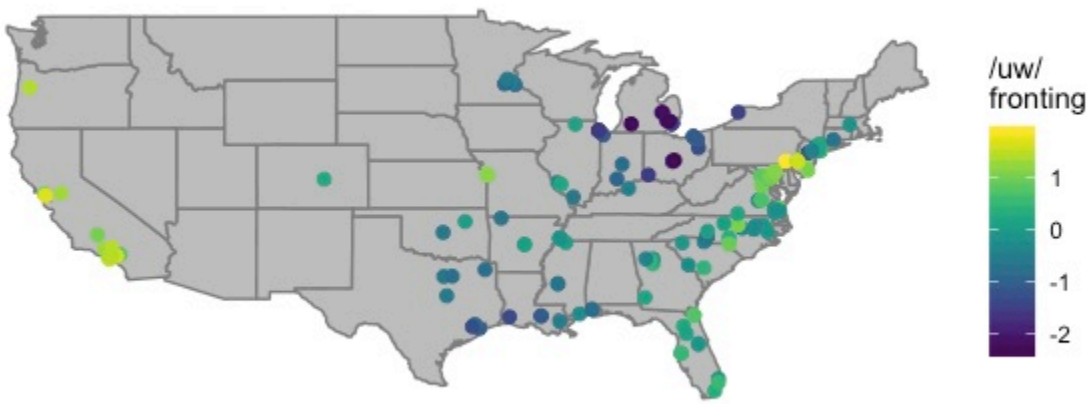


Figure 4.34: fronting and raising of /uw/ Gi* with 15NN

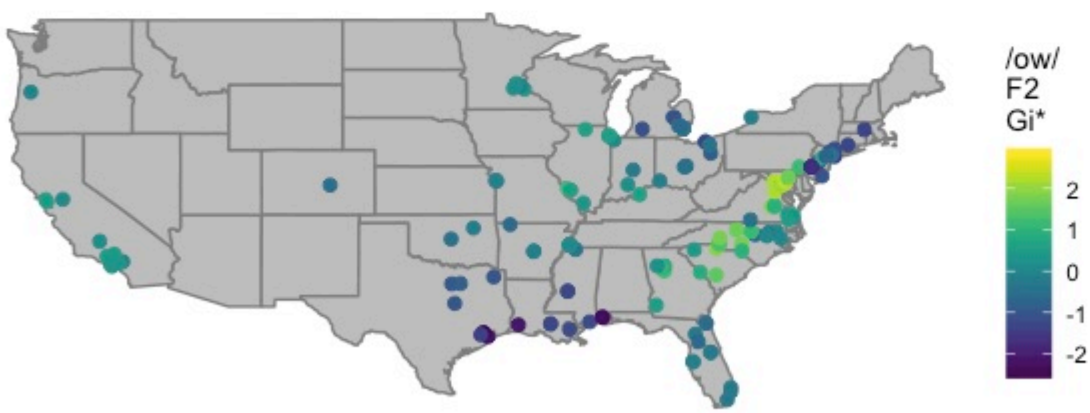


Figure 4.35: F2 of /ow/ Gi* with 15NN

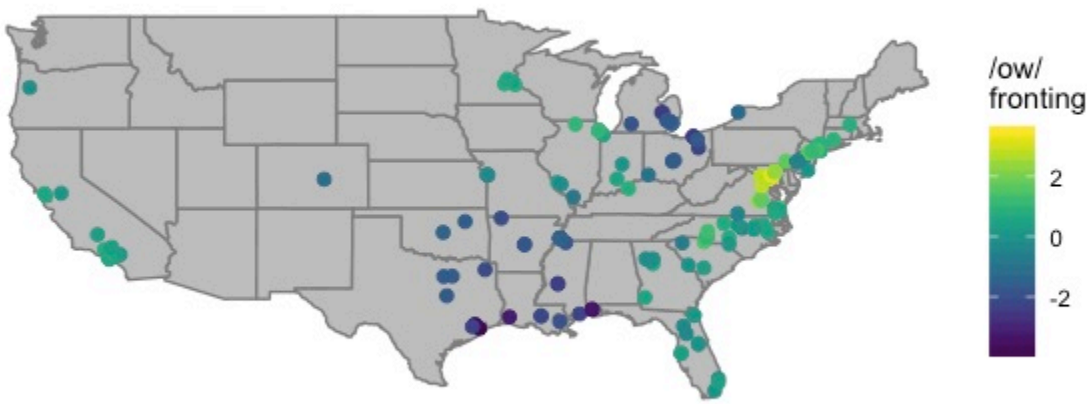


Figure 4.36: fronting and raising of /ow/ Gi* with 15NN

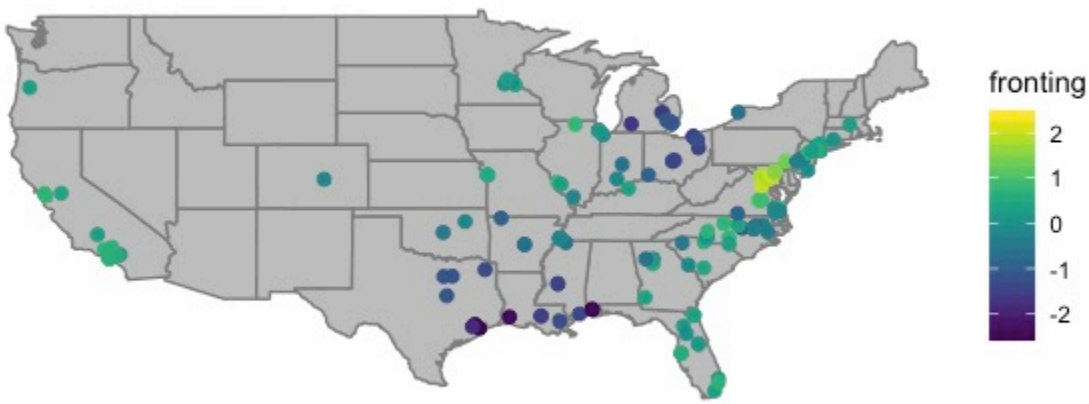


Figure 4.37: Fronting and raising of /uw/ and /ow/ Gi* with 15NN

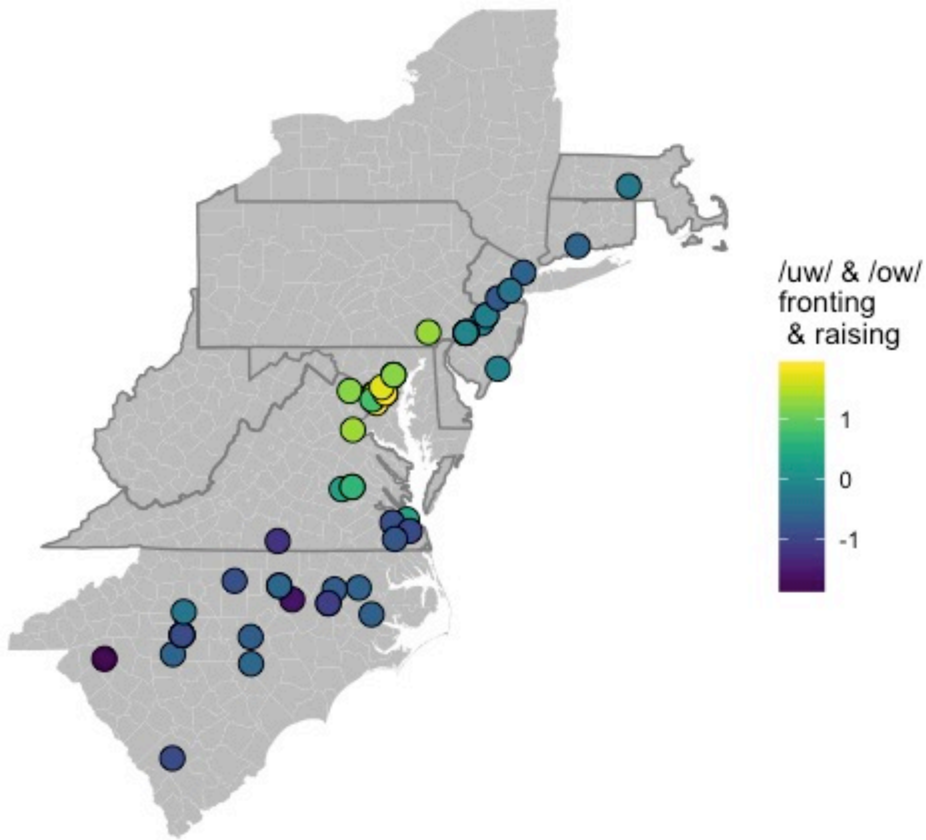


Figure 4.38: Fronting and raising of /uw/ and /ow/ Gi* with 15NN

does not extend westward in this sample as one would expect if it were mirroring European American fronting of /uw/ (figure 4.33). It also exhibits a degree of raising, most notably from Washington D.C. to Philadelphia, as expected, and in California (figure 4.34). There is not an appreciable difference in the geographic distrubution of fronting of /uw/ by condition – that is, following a coronal or non-coronal segment, or preceding a liquid – although, as expected, /uw/ following a coronal and preceding /l/ is significantly fronter.

Similarly, /ow/ exhibits fronting along the mid-Atlantic, further north than described for European American English, and not as far west (figure 4.35). It also exhibits a degree of raising (figure 4.36). These patterns are most strongly resisted int the Gulf states.

The fronting of /uw/ has a wider geographic spread than the fronting of /ow/, consistent with what we would expect from previous literature on the fronting of back vowels (Labov, 1994; Labov et al., 2005). This pattern is also consistent with a wave model of geographic diffusion, at least along the mid-Atlantic, suggesting Washington D.C. and Baltimore as possible places of origin (figures 4.37 and 4.38).

The Back Upgliding Shift

The Back Upgliding Shift, in which the nucleus of /oh/ fronts and lowers toward /aw/ or /æ/ and the nucleus of /aw/ rises, especially before nasals, is also present in the AAE data. Again, it does not pattern geographically with the Back Upgliding Shift as described in European American English in the ANAE.

The nucleus of /aw/ remains very low in Michigan and Ohio, and relatively low in the Midwest around Washington D.C., and in parts of the Gulf. It is significantly raised in the Southeast (figure 4.39).

The nucleus of /oh/ is fronted again in the corridor from the Gulf States to the Great Lakes, but remains back in Michigan and Ohio, and along the East Coast, especially around the Washington D.C. area (figure 4.40).

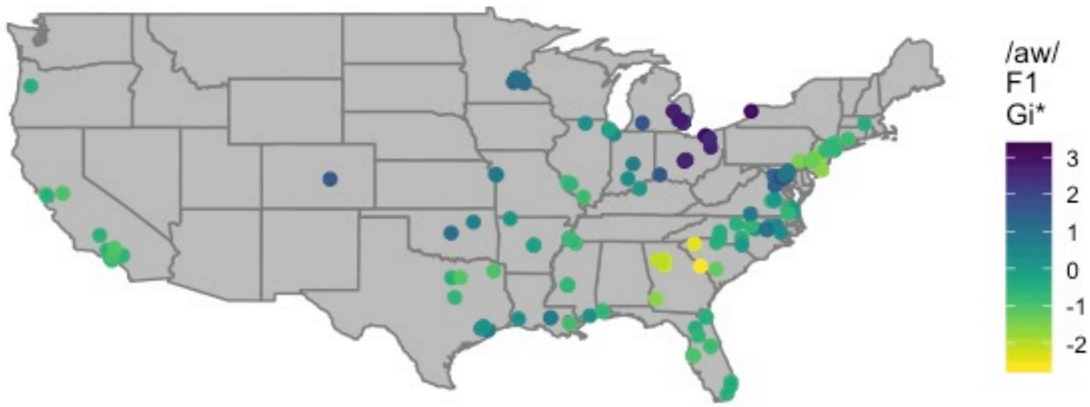


Figure 4.39: F1 of /aw/ Gi* with 15NN

The nucleus of /oh/ is extremely raised in New York City and its environs, conforming to the enregistered pronunciation that cuts across ethnic groups in the Northeast, where /oh/ is realized as [ʊ͡ɔ] or [u͡ɔ]. From the Gulf States up toward the Great Lakes, the nucleus of /oh/ is fronted and lowered toward /æ/, so *hawk* is realized as [hæ͡ɔk] or [hæ͡ok].

Superimposing all three maps (and reversing the color of the F2 of /oh/ so that brighter color indicates greater participation in the Back Upgliding Shift), it becomes clear the shift is most present from the Gulf States all the way up the Mississippi, but is absent in the north from Michigan to Massachusetts (figure 4.42). Including non-fronted high back vowels makes the contrast even starker (figure 4.43).

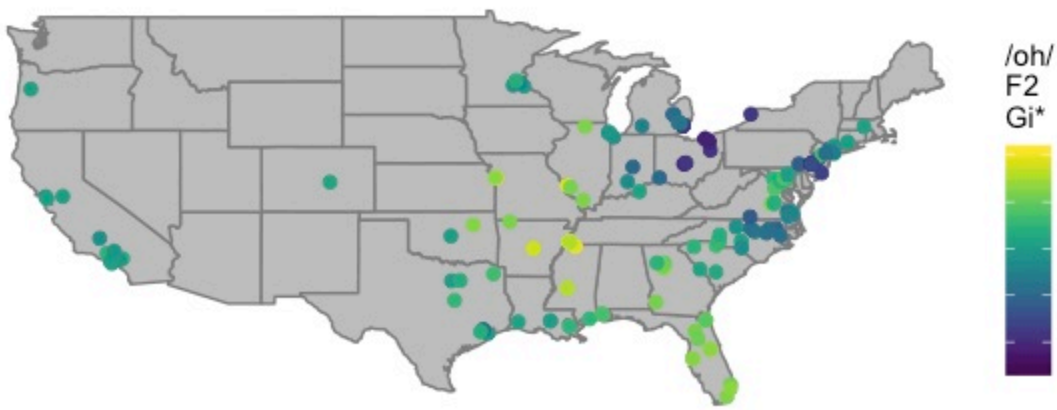


Figure 4.40: F2 of /oh/ Gi* with 15NN

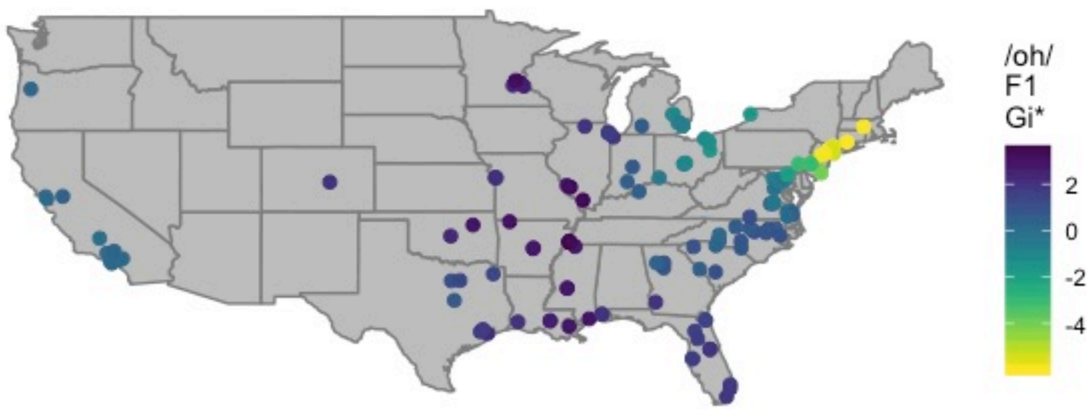


Figure 4.41: F1 of /oh/ Gi* with 15NN

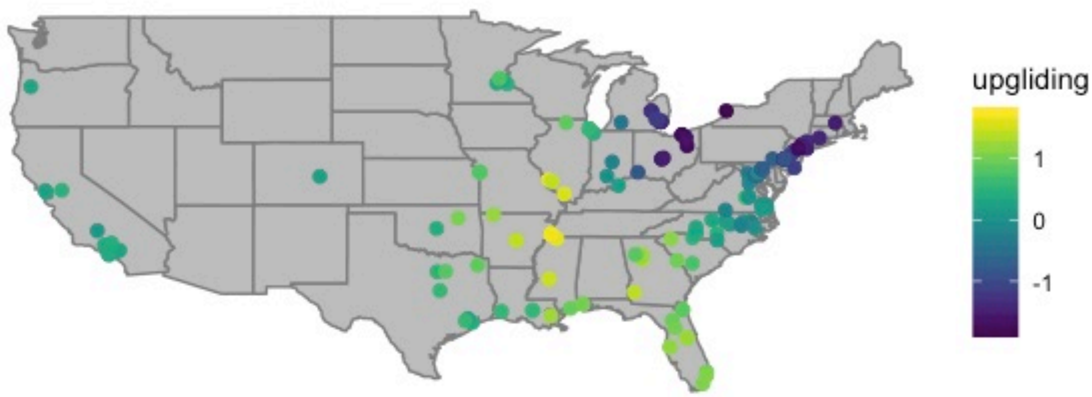


Figure 4.42: The Back Upgliding Shift, Gi* with 15NN

Figure 4.43: The Back Upgliding Shift, with non-fronted /uw/ and /ow/, Gi* with 15NN

Other Patterns

A few other patterns that do not correspond to either the AAVS or other previously described chain shifts are of interest. First, the monophthongization of /ay/ exhibits clearer spatial variation after the application of the Getis-Ord Gi* statistic using 15 nearest neighbors. Monophthongization before vowels, pause, and voiced consonants exhibits some regional variation, with the least amount of relative monophthongization in the mid-Atlantic region (figure 4.44), however this should be taken with a grain of salt, as the vast majority of the tokens of /ayV/ were monophthongized (figure 4.46), and the smallest monophthongization score in the /ayV/ condition was 0.6 – just shy of the decision boundary of 0.75 (min: 0.6, mean: 0.9, median: 0.9, max: 1.38, see table 4.1). That is, values cluster as relatively more or relatively less monophthongized while monophthongization in the /ayV/ condition was still effectively universal.

However, monophthongization before voiceless consonants exhibited a surprising amount of variation, and that variation has a spatial component. While, on average, the AAE speakers in this sample retained diphthongal /ay/ before voiceless consonants (min: 0.047, mean: 0.67, median: 0.67, max: 1.139, see table 4.1), this was not always the case – quite a few exhibited categorical monophthongization of /ay/, contrary to expectations. Mover, this pattern is most pronounced in the North, where white English speakers *do not* monophthongize /ay/ (figure 4.45).

The PIN-PEN Merger already exhibited a strong regional character, but the using the Getis-Ord Gi* statistic with 15 nearest neighbors the regional pattern is very clear. In the Northeast, in particular, PIN and PEN cannot reliably be said to be merged (figure 4.47). This is born out by examining F1 and F2 plots of /i/ and /e/ before nasals for speakers from New York City (figure 4.49). For the speakers from Brooklyn who are seemingly PIN-PEN merged, an examination of their /i/ and /e/ before all conditions reveals that apparent merger may be a by-product of extremely close /i/ and /e/ in their vowel spaces, and not a conditioned merger (speakers coded *s1HWsYEGbY0z* and *s1LaEheELtzi* in figure 4.50). As described by King (2016), the merger is also not reliably present in California.

The COT-CAUGHT merger exhibits similar spatial variation – the vowels are largely distinct in AAE, even in places where they are not distinct in local European American English (figure 4.51). As expected, the two classes are completely distinct in New York City (figure 4.52). In California, they range from distinct (e.g., in Palmdale and Carson) to potentially merged in Valencia, and clearly merged in Bakersfield (figure 4.53). In Louisiana, /oh/ and /ah/ are indistinguishable by height, but the relative fronting of /ah/ means that the two classes remain distinct (figure 4.54). Finally, in most of Georgia and Florida, the two classes are totally merged (figure 4.55).

Lastly, /u/ is lowered significantly in the Deep South, especially Georgia and South Carolina (figure 4.56).[4]

/ay/	/ayC/
Min. :0.60	Min. :0.047
1st Qu.:0.85	1st Qu.:0.561
Median :0.90	Median :0.674
Mean :0.90	Mean :0.665
3rd Qu.:0.94	3rd Qu.:0.767
Max. :1.38	Max. :1.139

Table 4.1: Monophthongization of /ay/ by condition

[4]From time spent in Alabama and from AAE-speaking contacts who did not participate in the present study, I can add that it seems as though /u/ is more strongly lowered before nasals, resulting in wɑmən '*woman*' and [wɑnt] '*want*', however there are insufficient observations of the appropriate vowel classes in *Junebug Goes to the Barber* to allow for an investigation of this phenomenon.

Figure 4.44: Monophthongization of /ayV/ Gi* with 15NN

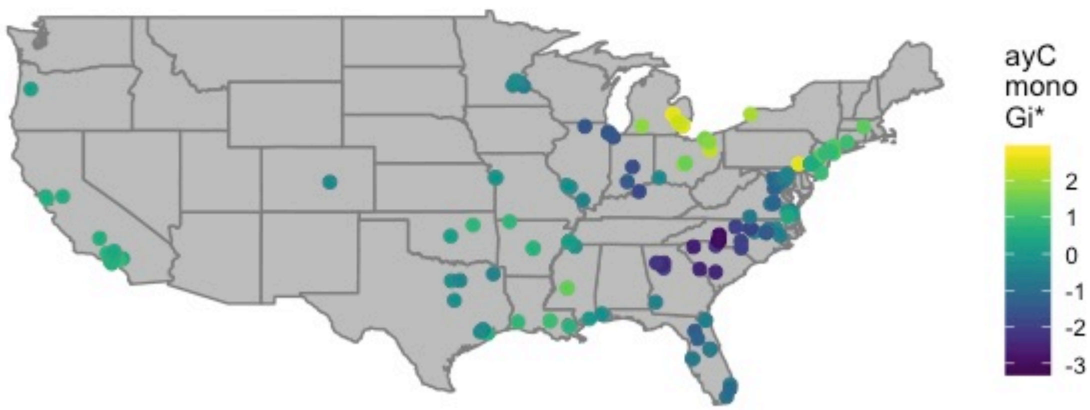


Figure 4.45: Monophthongization of /ayC/ Gi* with 15NN

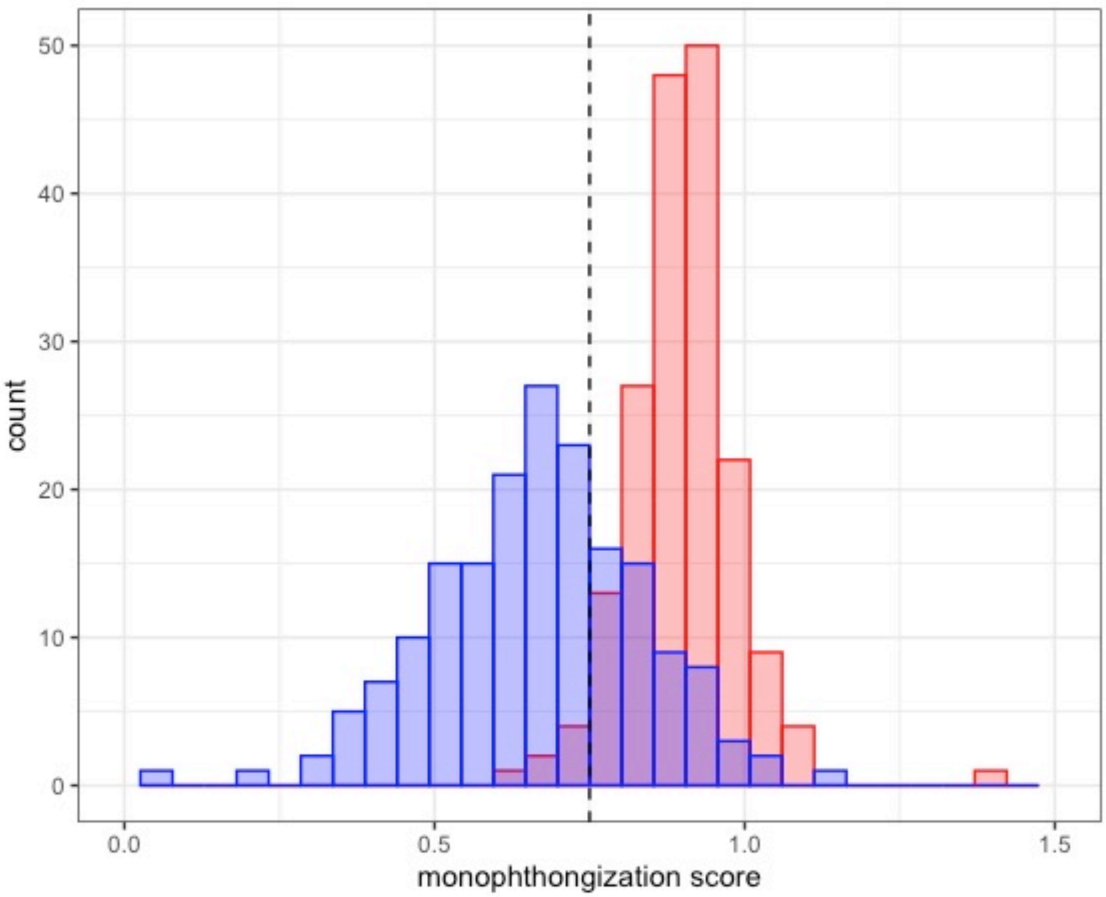


Figure 4.46: Monophthongization of /ay/ by condition (dashed line at decision boundary)

Figure 4.47: P-values for the Pillai score for /i/ and /e/ before nasals

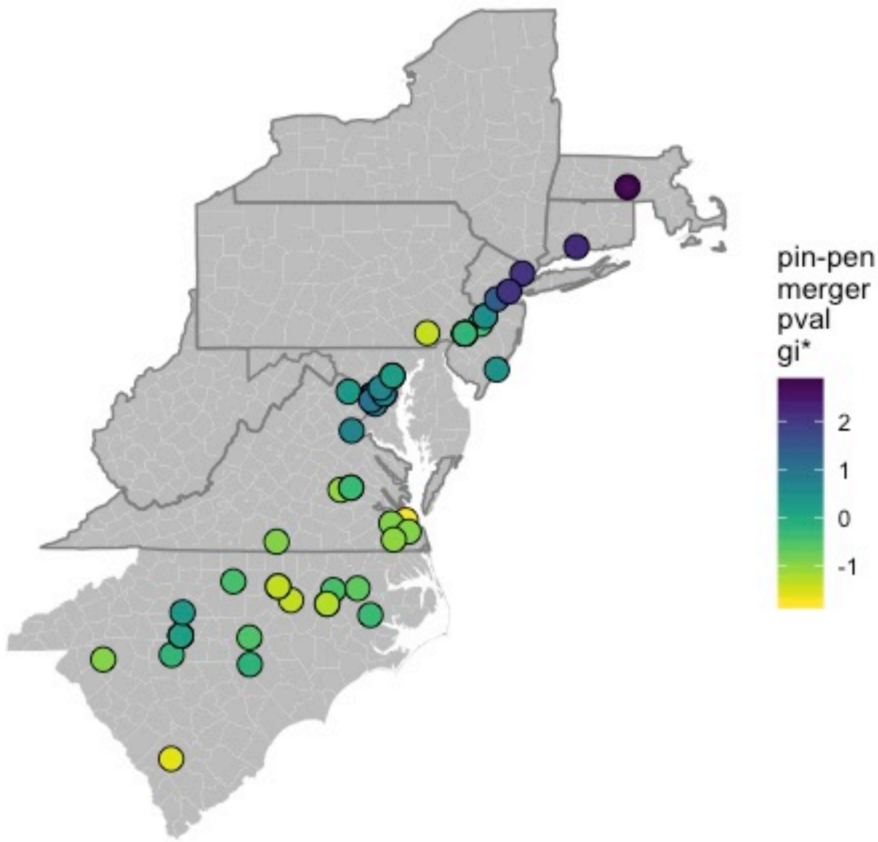


Figure 4.48: P-values for the Pillai score for /i/ and /e/ before nasals in the Mid-Atlantic and Northeast

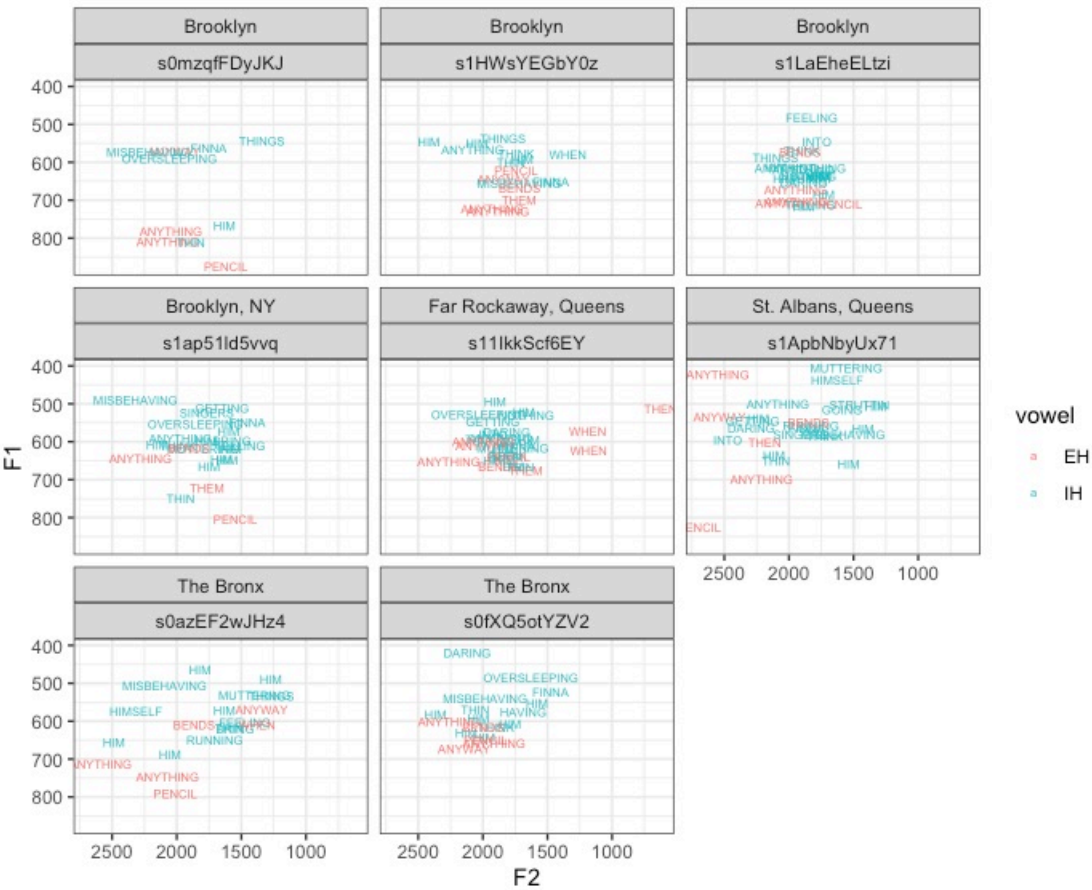


Figure 4.49: /i/ and /e/ before nasals for speakers from New York City

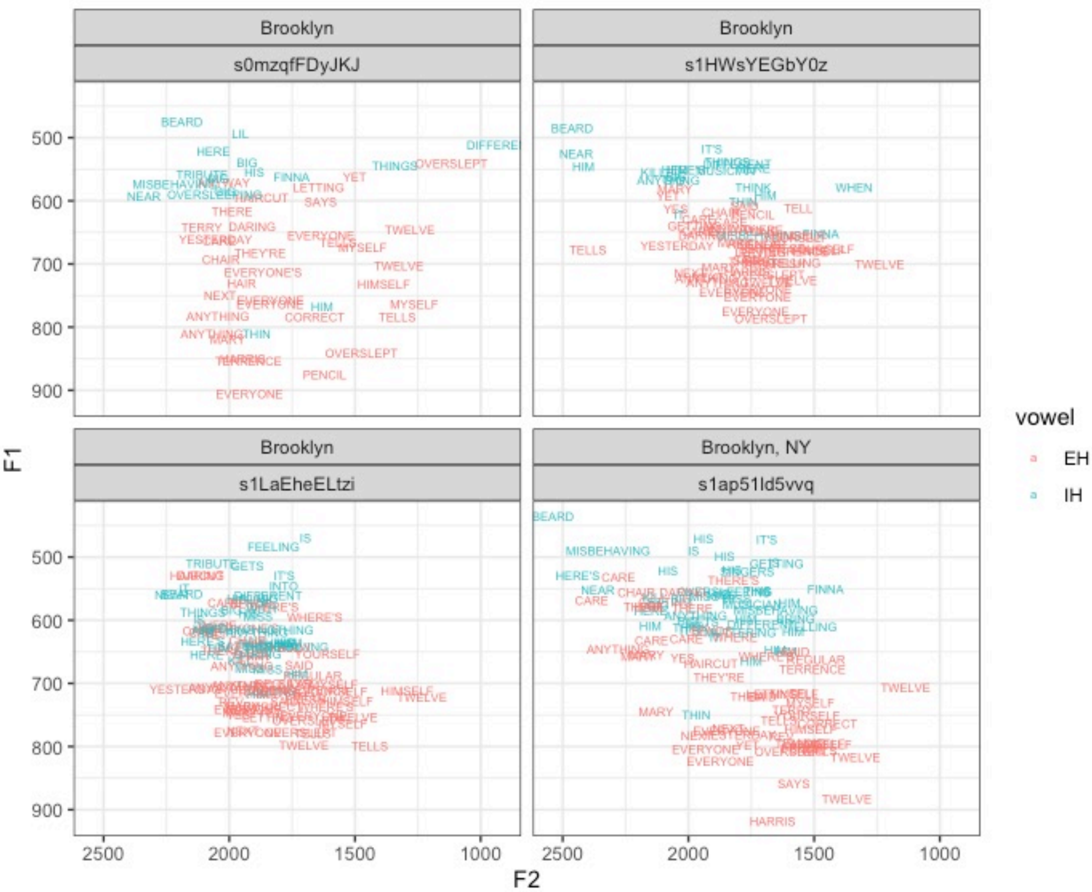


Figure 4.50: /i/ and /e/ for speakers from Brooklyn

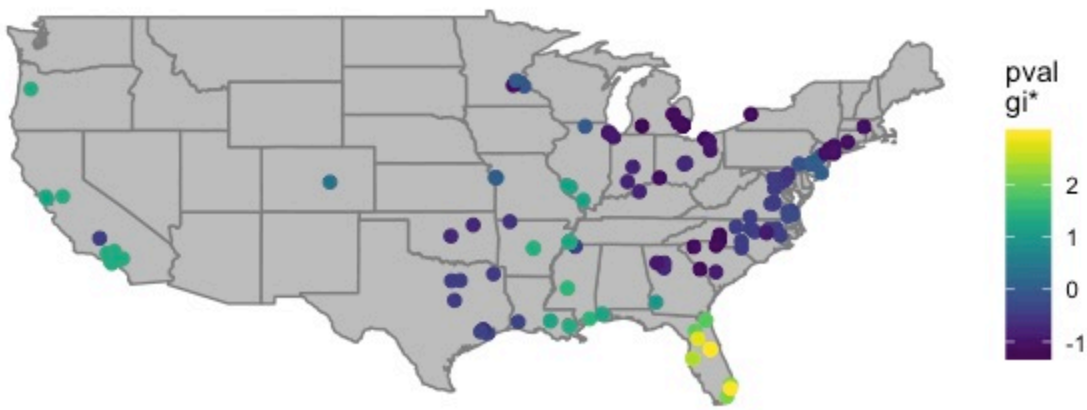


Figure 4.51: COT-CAUGHT Merger p-value Gi* with 15NN

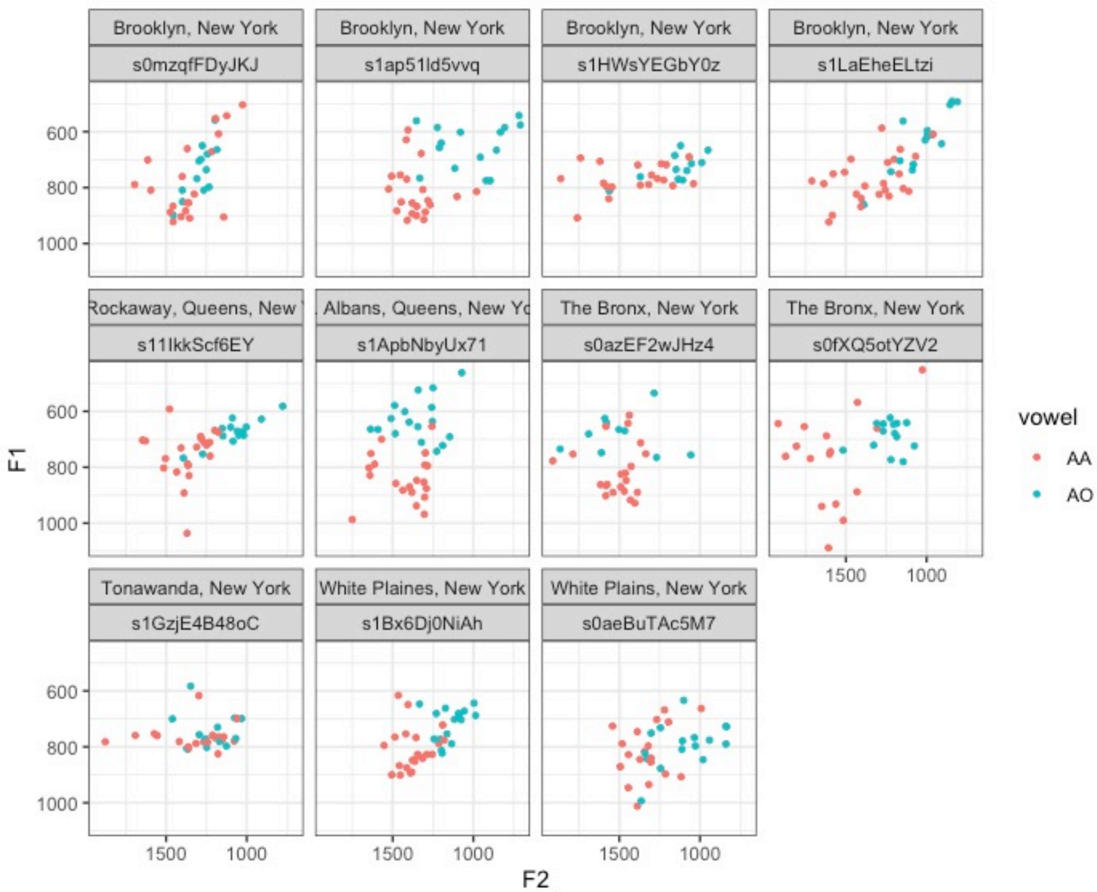


Figure 4.52: The low-back vowels in New York (not preceding /r/)

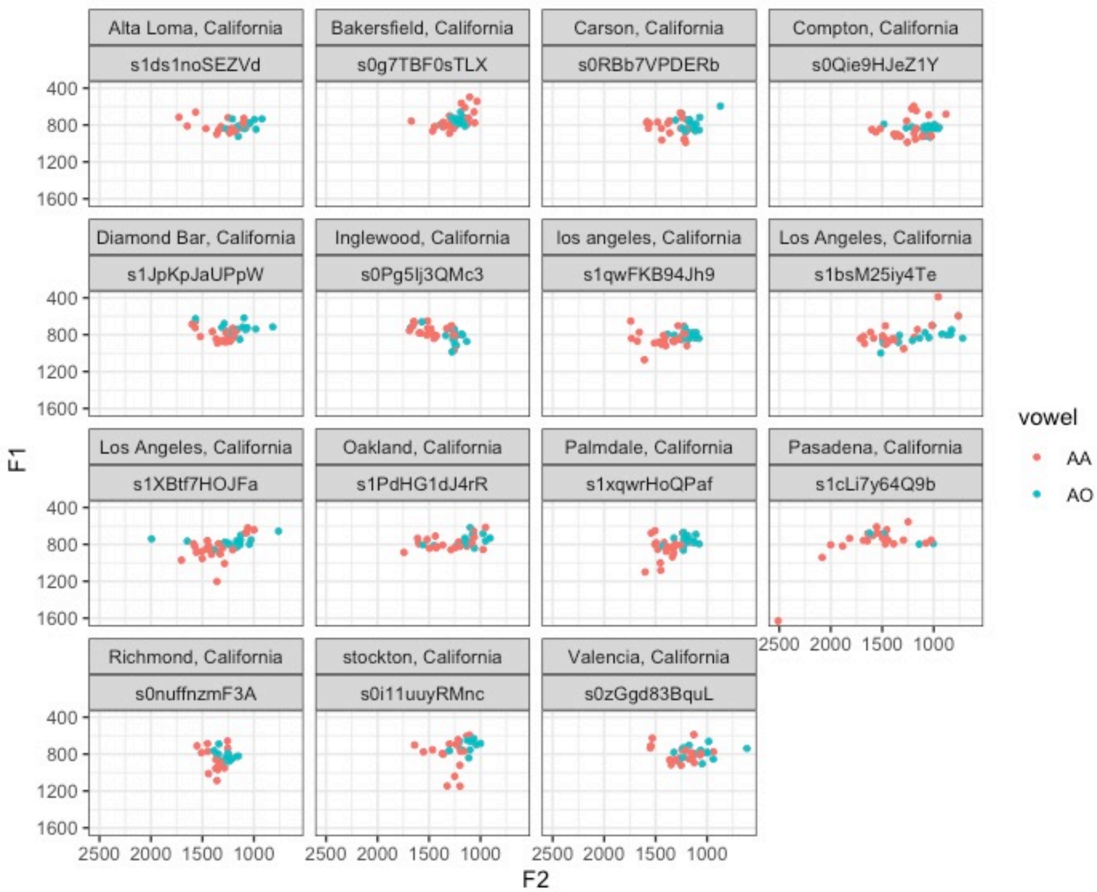


Figure 4.53: The low-back vowels in California (not preceding /r/)

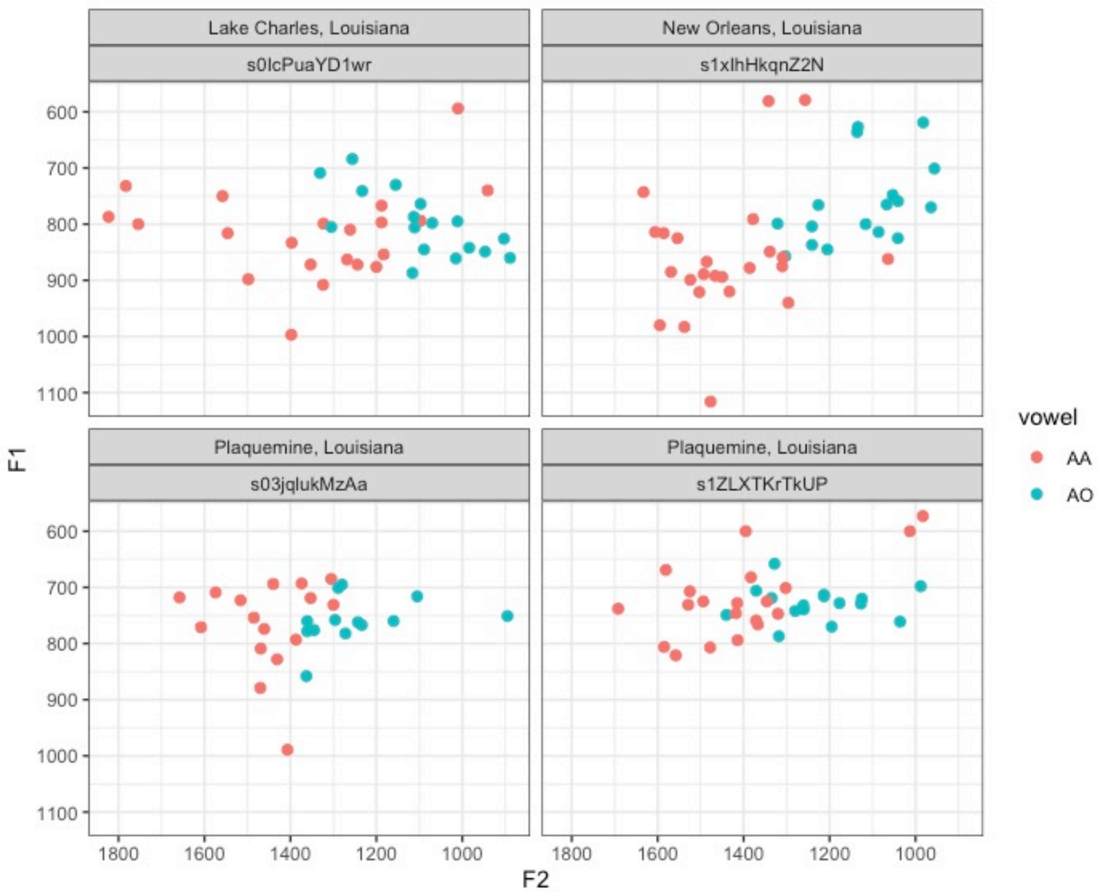


Figure 4.54: The low-back vowels in Louisiana (not preceding /r/)

Figure 4.55: The low-back vowels in Georgia and Florida (not preceding /r/)

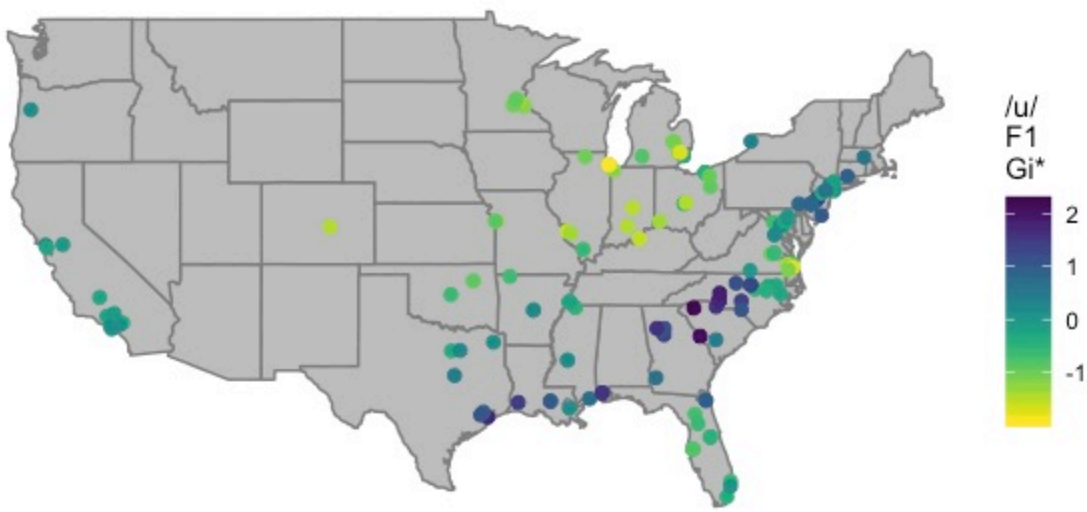


Figure 4.56: F1 of /u/, Gi* 15NN

4.2.6 Kriged Gi* estimates

Contrary to the situation with the raw formant data, the Gi* values with using 15 nearest neighbors for all vowel formants exhibited sufficient spatial structure to allow for kriging. However, given that the AAE data is significantly sparser than the ANAE data, extreme care should be taken in interpreting the maps below. In all of the following maps, the kriging resulted in a smoothed interpolation for which each county has a value. While this interpolation is, by definition, the best linear unbiased estimate of intermediate values, this does not mean it is always a perfect indication of the underlying process that gave rise to the data.

Consider, as an example, the monophthongization of /ay/ before voiceless consonants. In figure 4.45, it is clear that the sampled data suggest a relatively higher degree of monophthongization of /ayC/ in Michigan, near Detroit. Note that there is no data in much of the middle of New York. Kriging correctly highlights the pattern in Michigan and Ohio, correctly captures the relative lack of monophthongization in Illinois and Indiana, and correctly characterizes New Jersey and New York City (figure 4.57), however, it potentially *incorrectly* highlights the area around Syracuse, New York as exhibiting /ayC/ monophthongization. While this is possible, it is an extrapolation of the broader trend in the data, and not supported by evidence from Syracuse.

This should be kept in mind when interpreting the following maps, especially with regards to the West. There is almost no black population in Washington, Idaho, Montana, North Dakota, South Dakota, Wyoming, Nebraska, Nevada, Utah, Arizona, and New Mexico, and there are no observations in my sample from those states. As such, while we can have a relatively high degree of confidence in the interpolated values for California, the values in the Western States should not be interpreted as providing meaningful estimates of African American vowels, as such an estimate is meaningless in the absence of African American people.

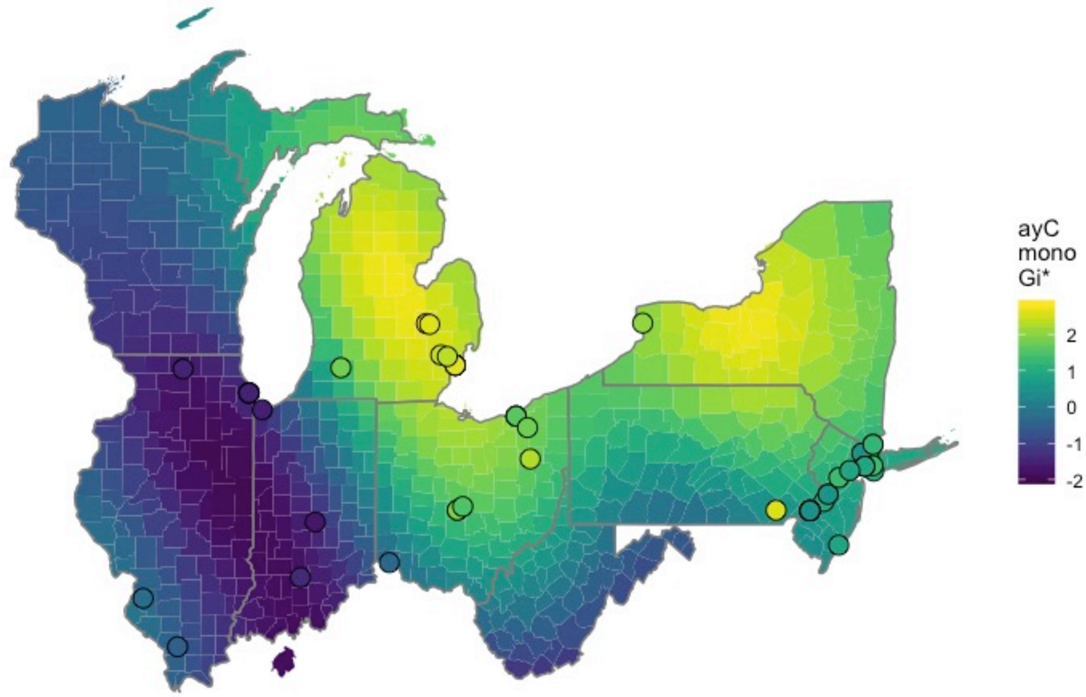


Figure 4.57: Monopthongization of /ayC/ Gi* with 15NN and interpolated values

Finally, only the extreme high and low values should be treated as indicative of a regional pattern. These points in mind, the smoothed and interpolated maps below can provide another degree of nuance to the interpretation of regional variation in African American English.

The AAVS

As should be expected, given the relative lack of spatial structure in the raw data, there is not much variation in /iy/ after applying the Getis-Ord Gi* statistic with 15 nearest neighbors, however there are apparent hot spots corresponding to raised /iy/ in the Chicago, Kalamazoo, and Baltimore. /iy/ is lowered in inland North Carolina, and in parts of the Gulf (figure

4.58).

As figure 4.59 shows, /iy/ is relatively backer in east Texas and Louisiana, Indiana, Norfolk and Virginia Beach, and around Philadelphia, and relatively fronter in California, Chicago, South Carolina, the Washington D.C. area. Neither the F1 nor F2 of /iy/ exhibits strong variation or a clear regional pattern.

With /i/, a now familiar pattern begins to emerge: /i/ is relatively raised west of the Mississippi from the Gulf up toward the Great lakes, with strongest raising in Minneapolis and inland in the Carolinas (figure 4.60).

The F2 of /i/ exhibits an even stronger regional pattern, following the same path up the west side of the Mississippi (figure 4.61).

As described above, /ey/ is dramatically lowered in along the same corridor, and highest in the Northeast (figure 4.62). It is also backed significantly from the Gulf, up the country west of the Mississippi (figure 4.63). Kriging helps draw out that the same backing appears to a lesser degree in Michigan and Ohio.

The F1 of /e/ appears as almost a mirror image of the F2 of /ey/, raising in all the same places that /ey/ backs (figures 4.63 and 4.64). Similary, /e/ is relatively raised where it is relatively front, and also relatively raised around Virginia Beach (figure 4.65).

Superimposing the reversal of /ey/ and /e/ – the same reversal as stage 2 of the Southern Vowel Shift – it becomes clear that there is a strong regional pattern which does not pattern geographically with the second stage of the Southern Vowel Shift. Rather, it follows corridors of the Great Migration up the country west of the Mississippi from the Gulf toward the Great Lakes (figure 4.66).

Performing the same procedure with /iy/ and /i/ – the same reversal as stage 3 of the Southern Vowel Shift – a similar pattern is present, but less strongly apparent. Where it differs is that it is more intense in inland North Carolina than elsewhere (figure 4.67).

In the Gulf, /æ/ is significantly raised compared to elsewhere (figure 4.68), and this is much more clearly apparent (as is the lowest /æ/ in California and New York) after kriging. It is also significantly backed in California, as the speakers in this sample were evidently participating in the broader, cross-ethnic pattern TRAP-backing in California. While relatively raised, it was also relatively backed in Georgia and South Carolina, meaning there is a range of realizations of /æ/ in various parts of the country, from [e] in the Gulf, to [ɑ] in Southern California, and [ɛ] in Georgia.

The raising of /a/ and /ah/ is even more pronounced Florida and Georgia after kriging the Gi* data (figure 4.70). As with the point map above, the fronting of /ah/ does not seem to appear in the same places as the rest of the proposed, and /ah/ is relatively *back* in North Carolina, and relatively fronter around New York City (figures 4.71 and 4.72).

In the middle of the country /ʌ/ is both raised (figure 4.73) and backed (figure 4.74). This is most pronounced near Fayettville, Arkansas, Tulsa, Oklahoma, Kansas City, Missouri, St. Louis, Missouri, and Southern Illinois (figure 4.75).

Superimposing all the maps of the vowels that constitute the AAVS, as above, it becomes clear that there is a strong regional character to the shift, following patterns of migration northward from the Gulf States (figure 4.76). The AAVS is strongest in the Gulf from Texas to Alabama, and northward following the western side of the Mississippi, up to Illinois. It is also very strong in inland North Carolina. It is less visibly present all other locations east of the Mississippi, and along the West Coast. It is strongly resisted from Southern Virginia all the way through the the Northeast.

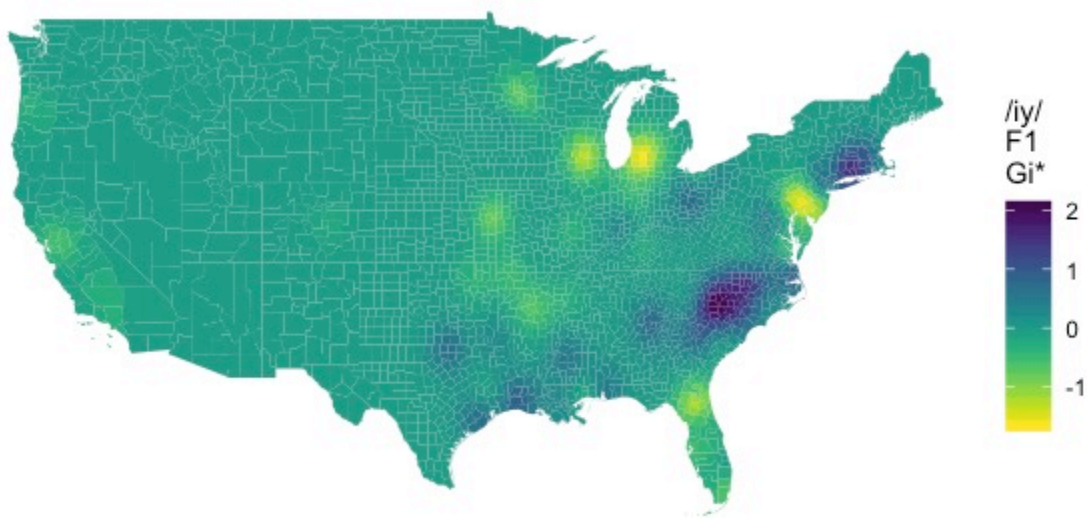


Figure 4.58: F1 of /iy/ Gi* with 15NN

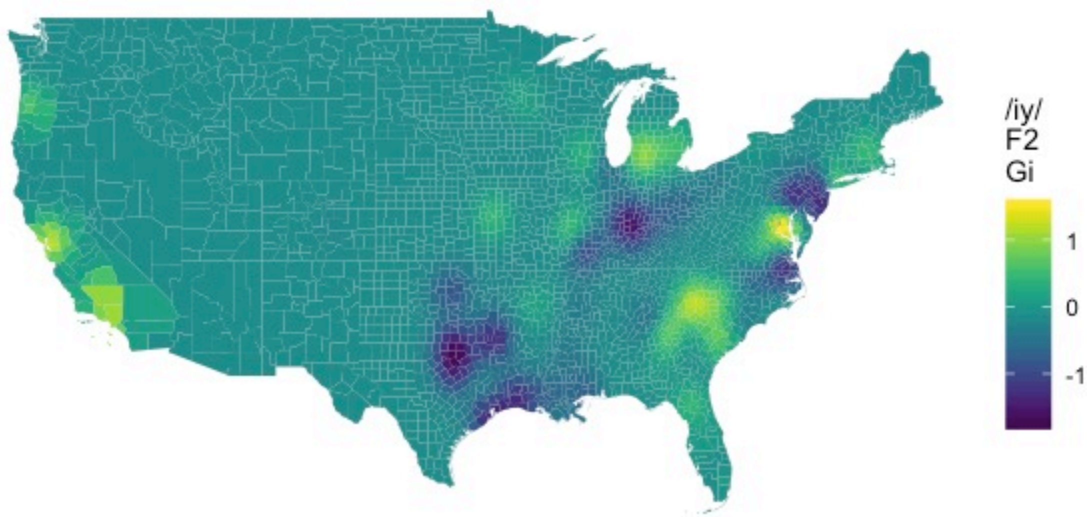


Figure 4.59: F2 of /iy/ Gi* with 15NN

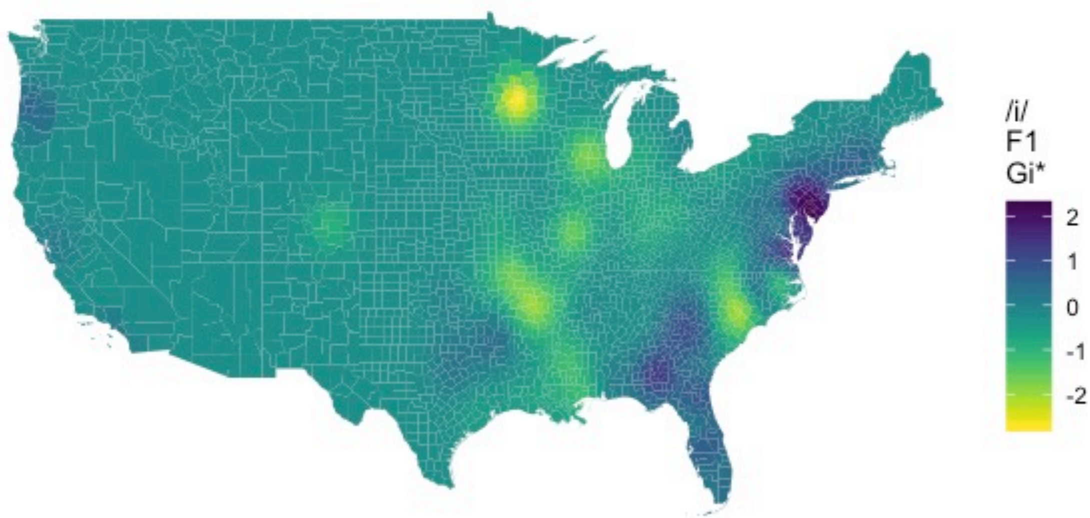


Figure 4.60: F1 of /i/ Gi* with 15NN

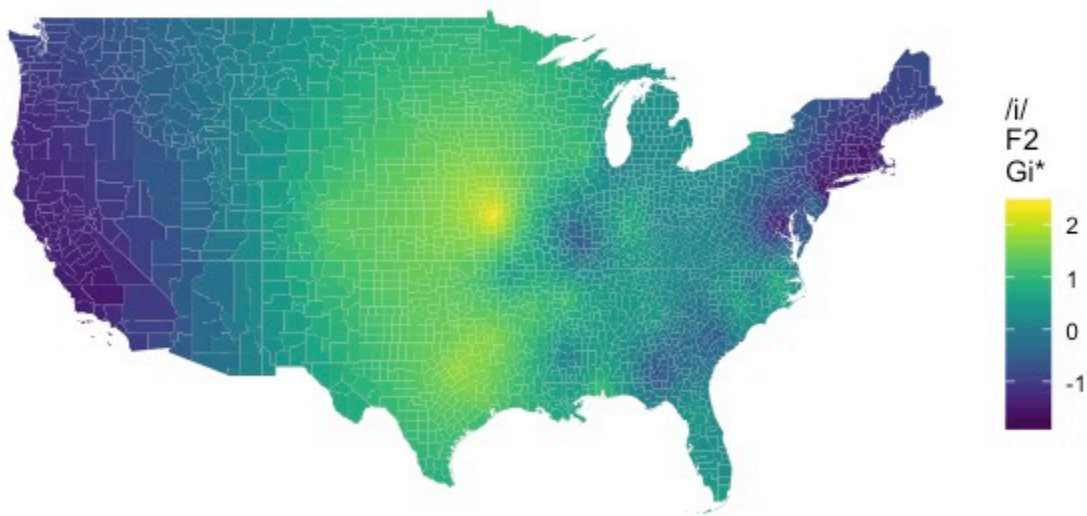


Figure 4.61: F2 of /i/ Gi* with 15NN

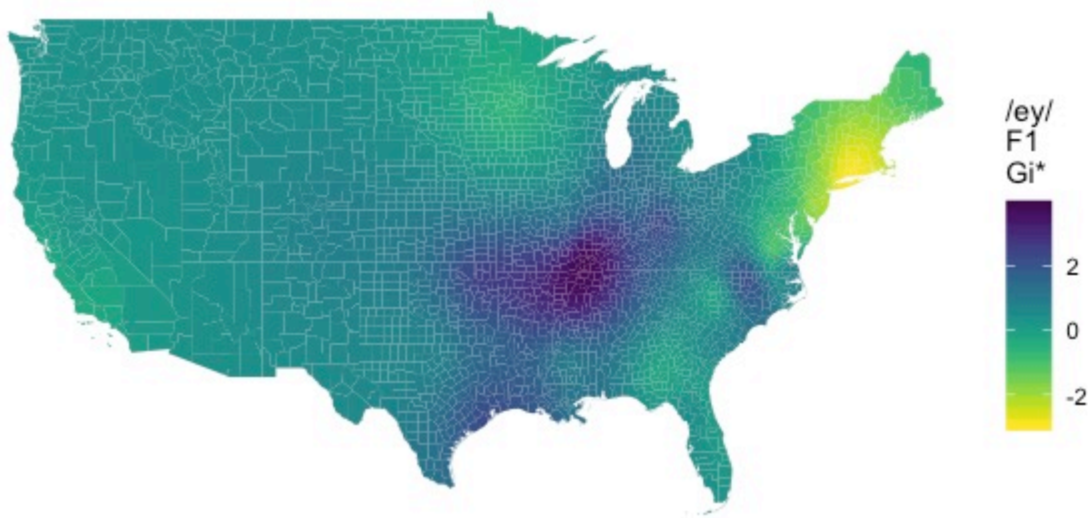


Figure 4.62: F1 of /ey/ Gi* with 15NN

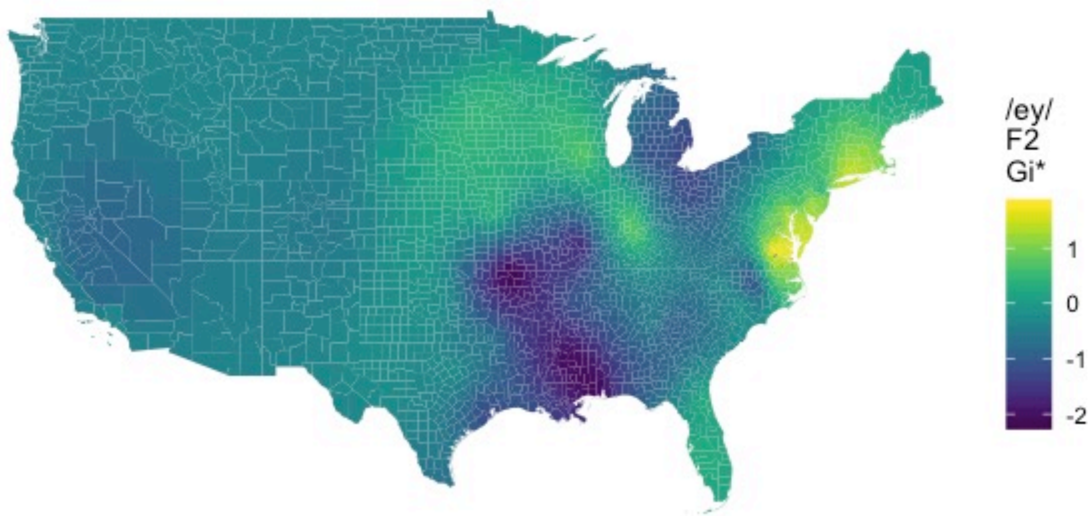


Figure 4.63: F2 of /ey/ Gi* with 15NN

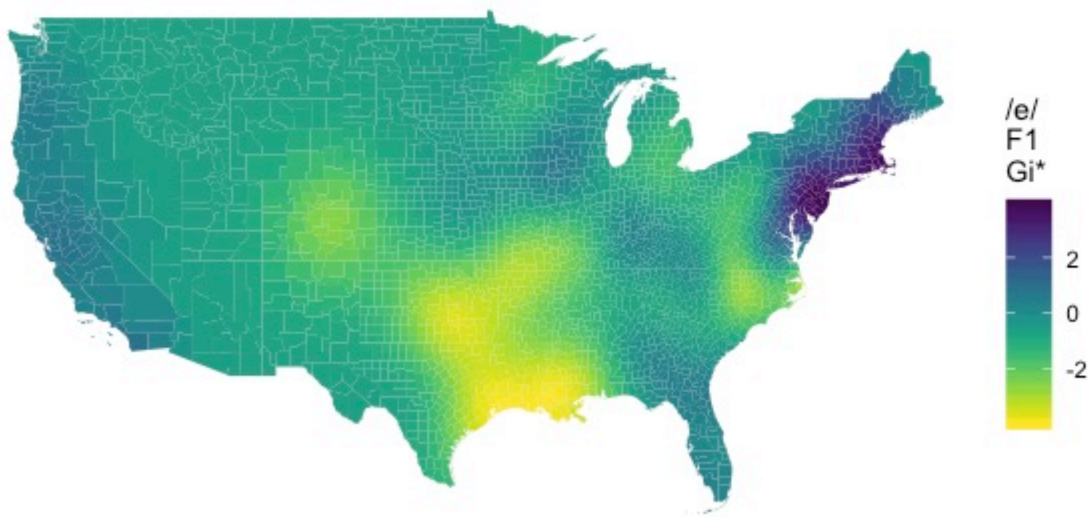


Figure 4.64: F1 of /e/ Gi* with 15NN

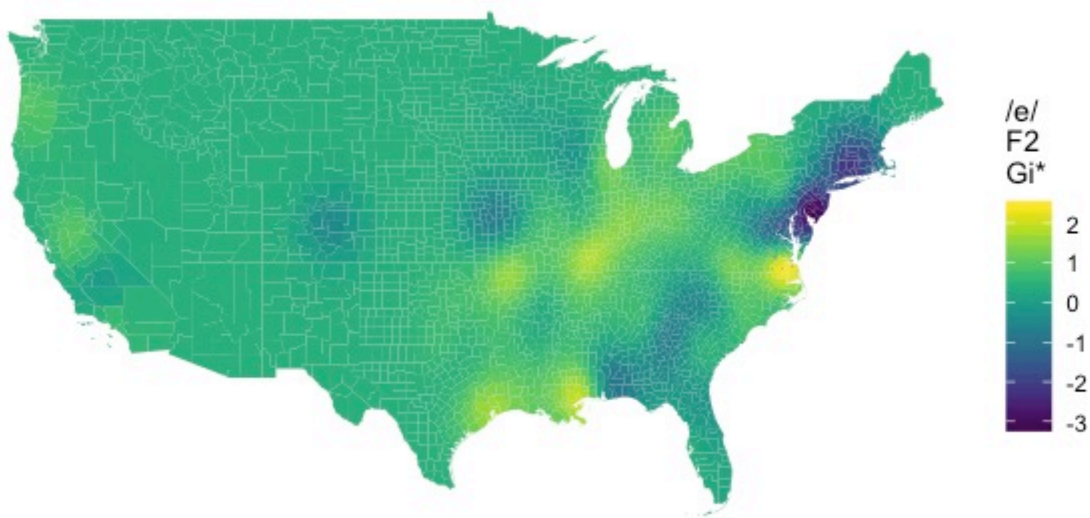


Figure 4.65: F2 of /e/ Gi* with 15NN

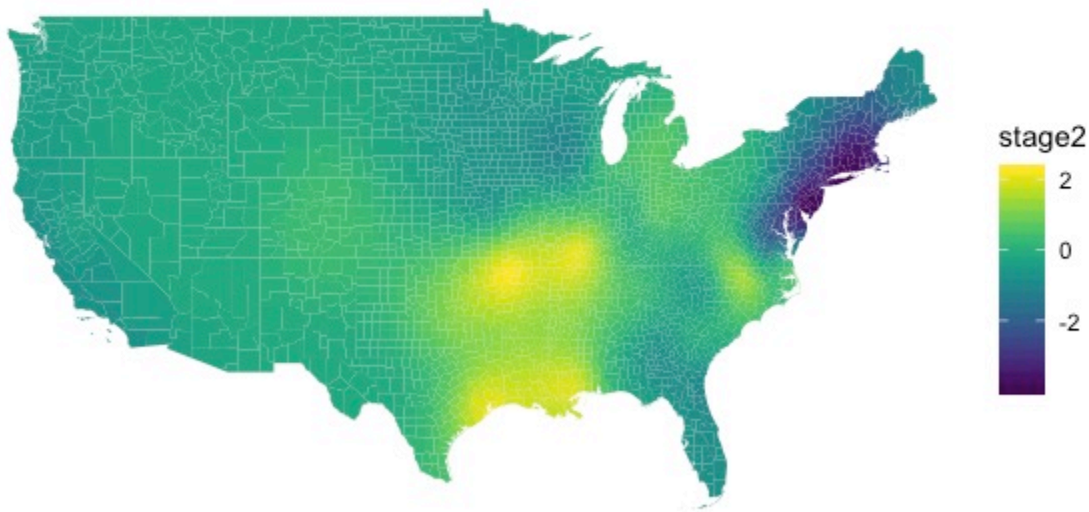


Figure 4.66: Stage 2 of the SVS (reversal of /ey/ and /e/) in AAE, Gi* with 15NN

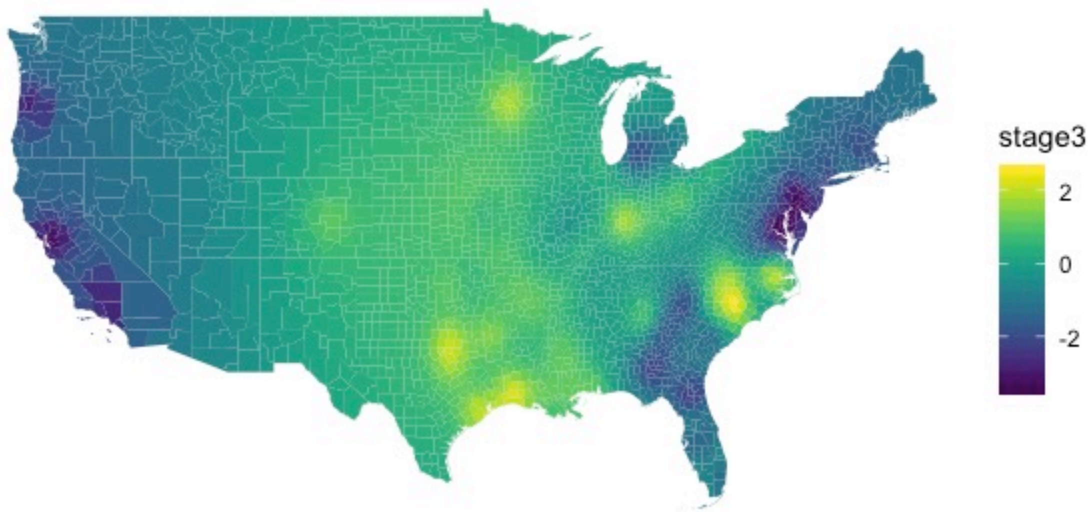


Figure 4.67: Stage 3 of the SVS (reversal of /iy/ and /i/) in AAE, Gi* with 15NN

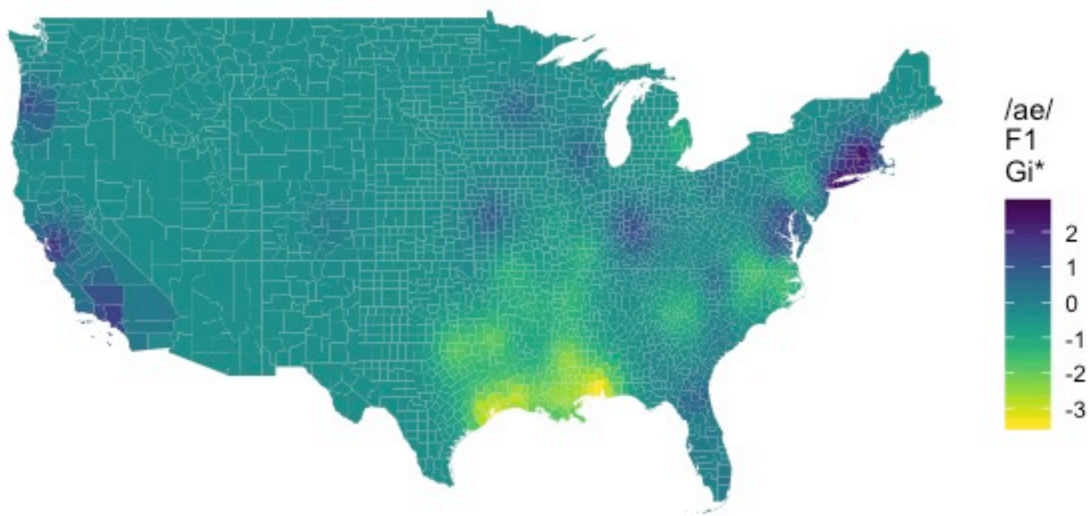


Figure 4.68: F1 of /ae/ Gi* with 15NN

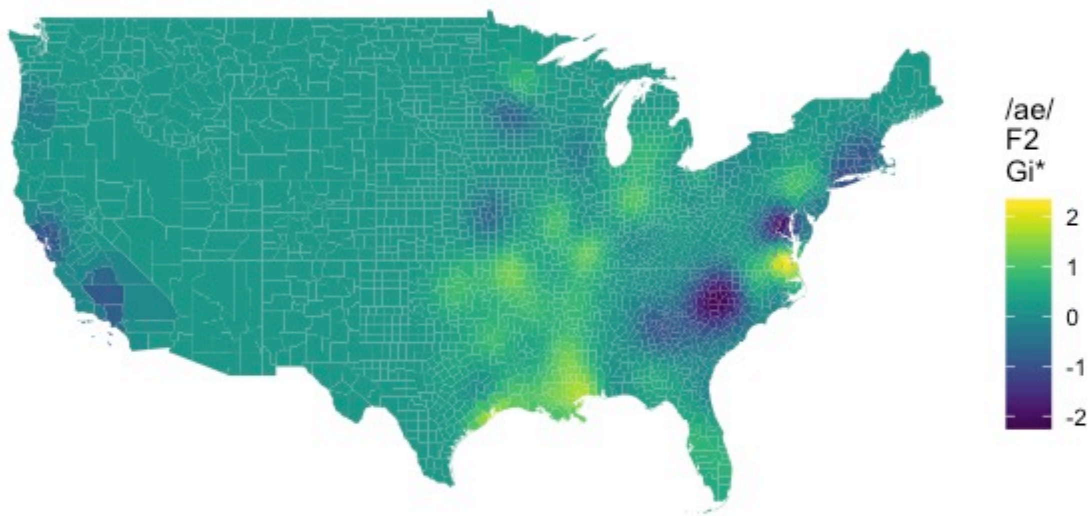


Figure 4.69: F2 of /ae/ Gi* with 15NN

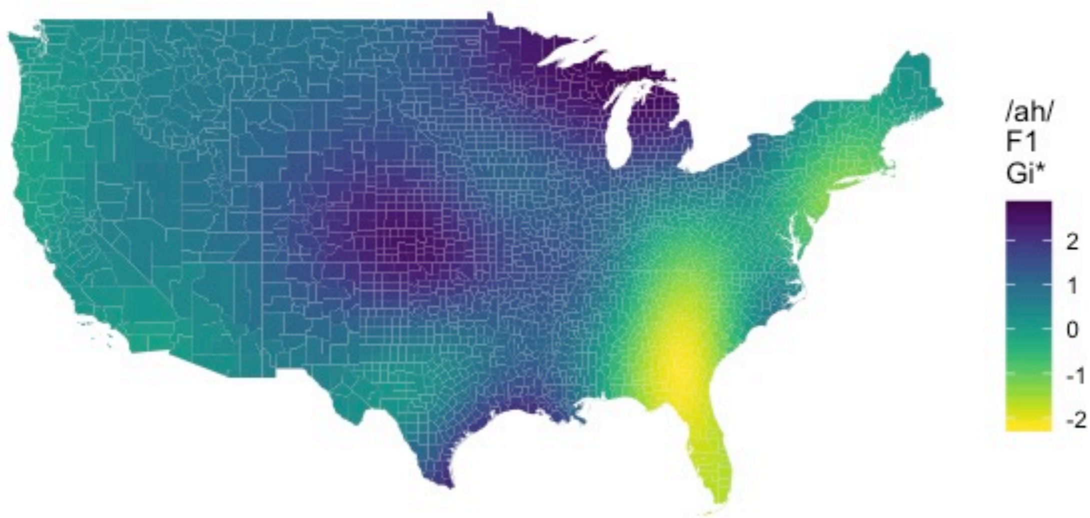


Figure 4.70: F1 of /ah/ Gi* with 15NN

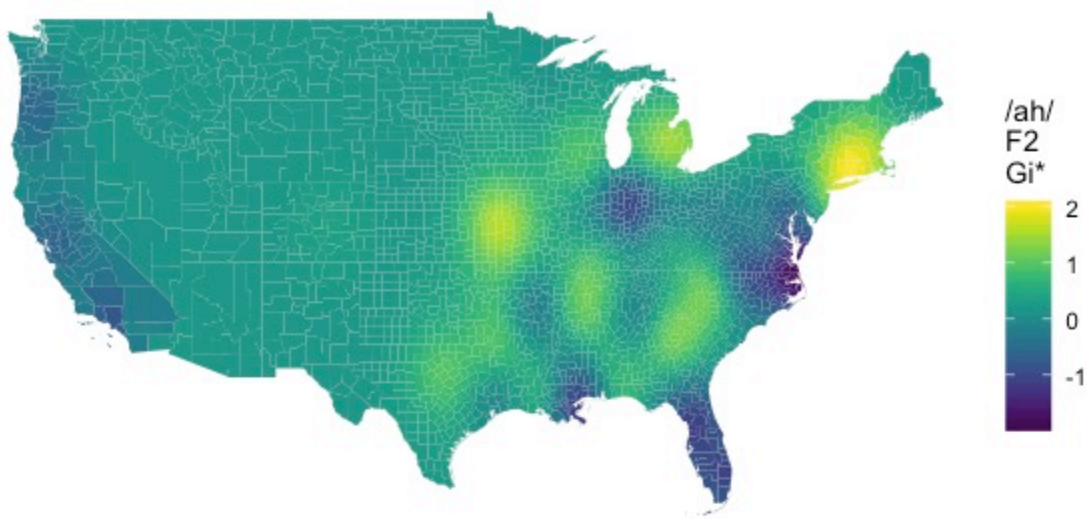


Figure 4.71: F2 of /ah/ Gi* with 15NN

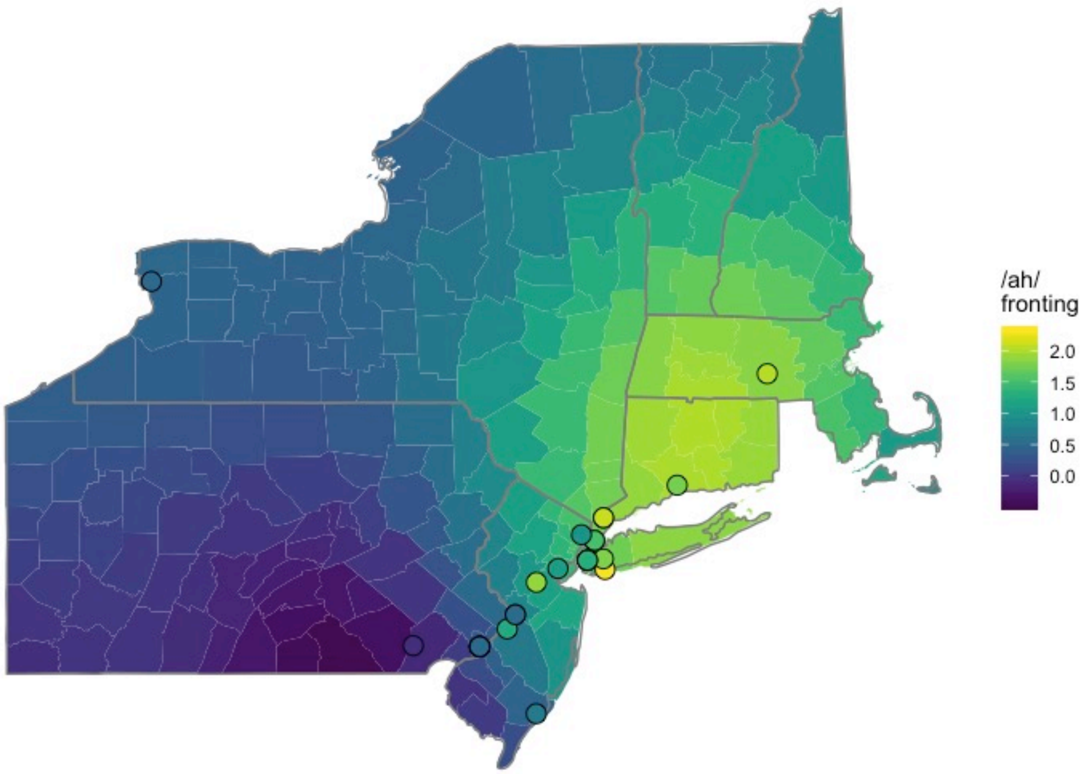


Figure 4.72: F2 of /ah/ Gi* with 15NN, in the Northeast

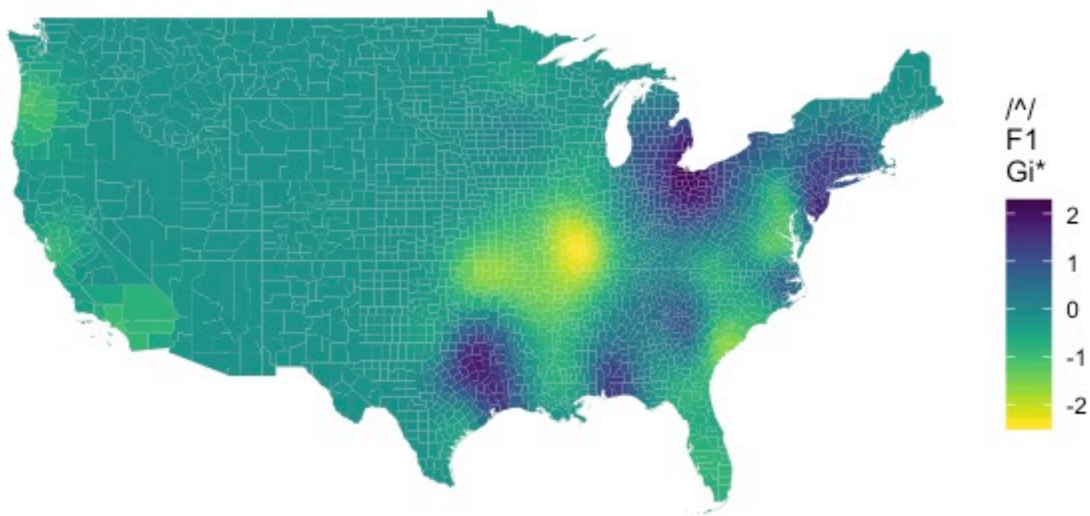


Figure 4.73: F1 of /ʌ/ Gi* with 15NN

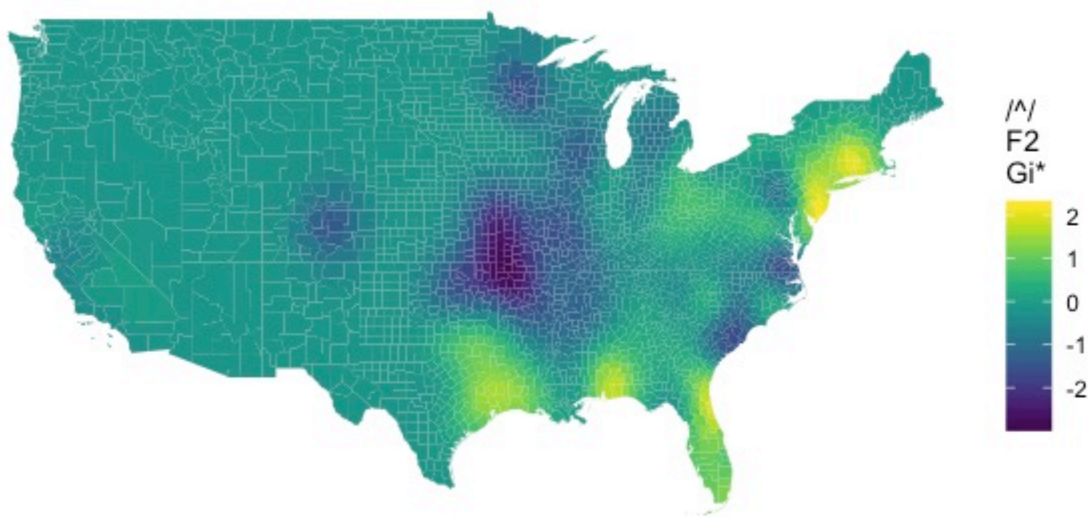


Figure 4.74: F2 of /ʌ/ Gi* with 15NN

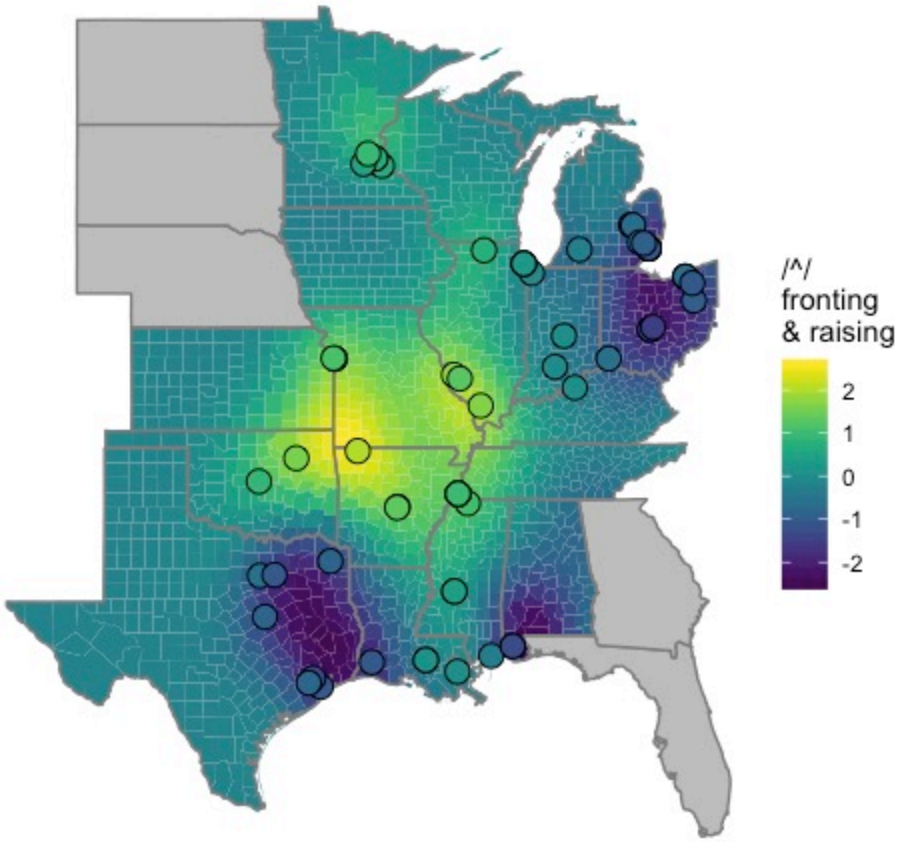


Figure 4.75: Raising and backing of /ʌ/ Gi* with 15NN

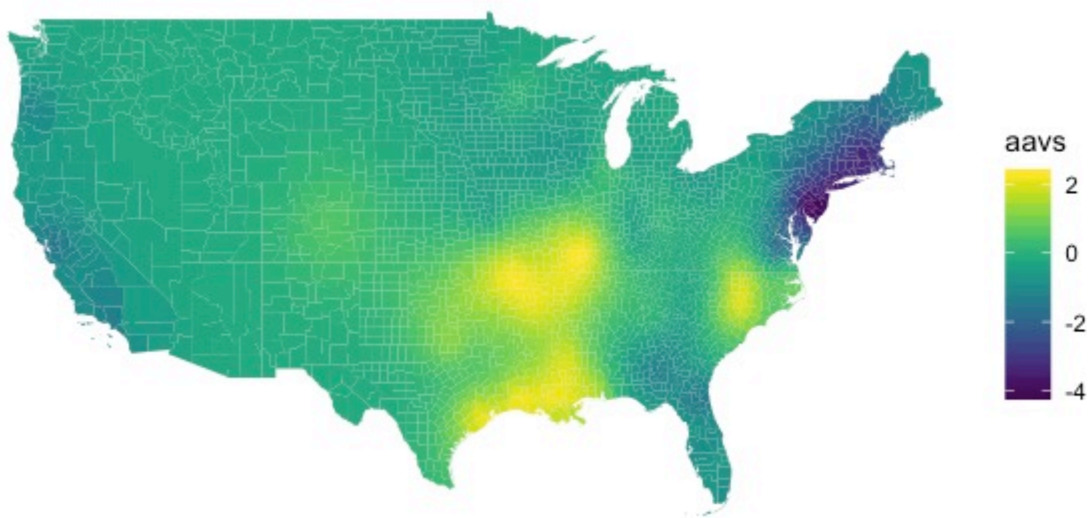


Figure 4.76: The AAVS

Fronting of Back Vowels

As with the point maps above, the fronting of back vowels is most apparent along the East Coast, in the Mid-Atlantic. The fronting of /uw/ covers a wider geographic territory than the fronting of /ow/ along the Mid-Atlantic (figures 4.77 and 4.78), and including raising, the pattern becomes more intense along the Mid-Atlantic (figures 4.79, 4.80, 4.81).

As figure 4.77 attests, fronting of /uw/ is also present along the West Coast, especially in California. While there is a range of values, it is clear from figure 4.82 that /uw/ fronting and raising is most noticeable in Los Angeles and in Oakland.

Turning back to the East Coast, superimposing the maps for the fronting of /uw/, the raising of /uw/, the fronting of /ow/, and the raising of /ow/, it is clear that the epicenter along the East Coast is Washington D.C. While this is supported in the literature (Lee, 2016), the shift is also present as far north as Philadelphia, which, while not present in earlier literature (Labov and Fisher, 2015) is attested in my recent work (Jones et al., 2019), but may be the result of contact with white speakers. More will be said on this in section 5.4, below.

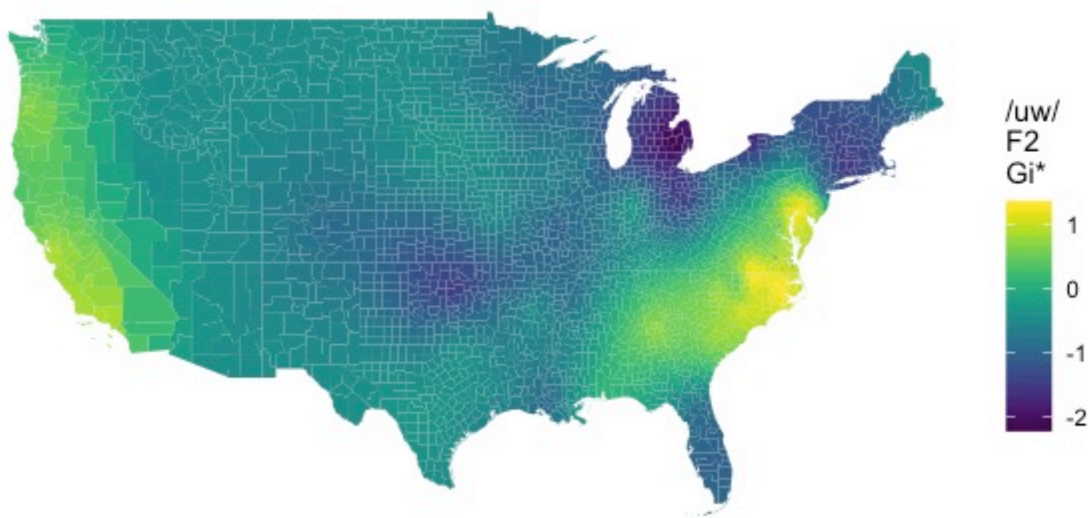


Figure 4.77: F2 of /uw/ Gi* with 15NN

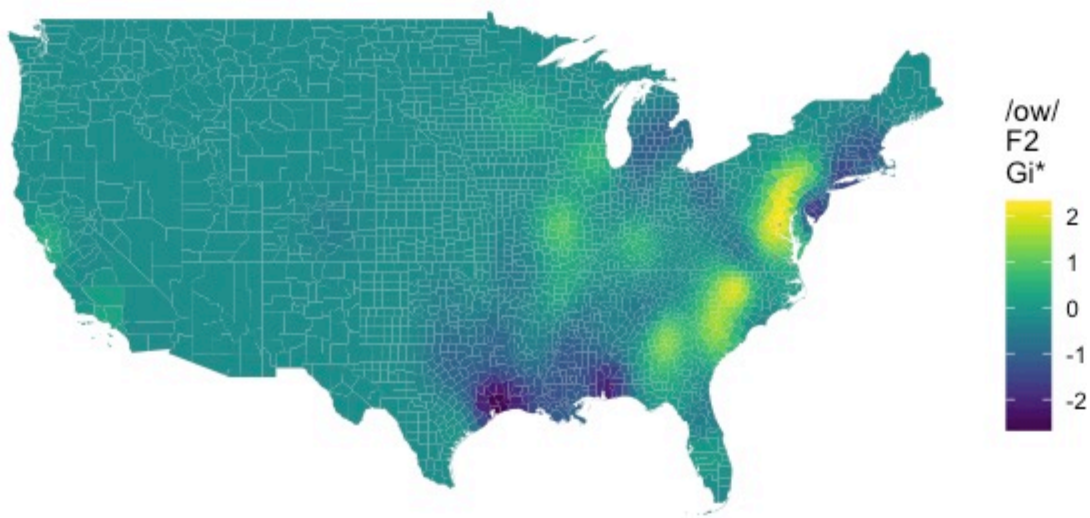


Figure 4.78: F2 of /ow/ Gi* with 15NN

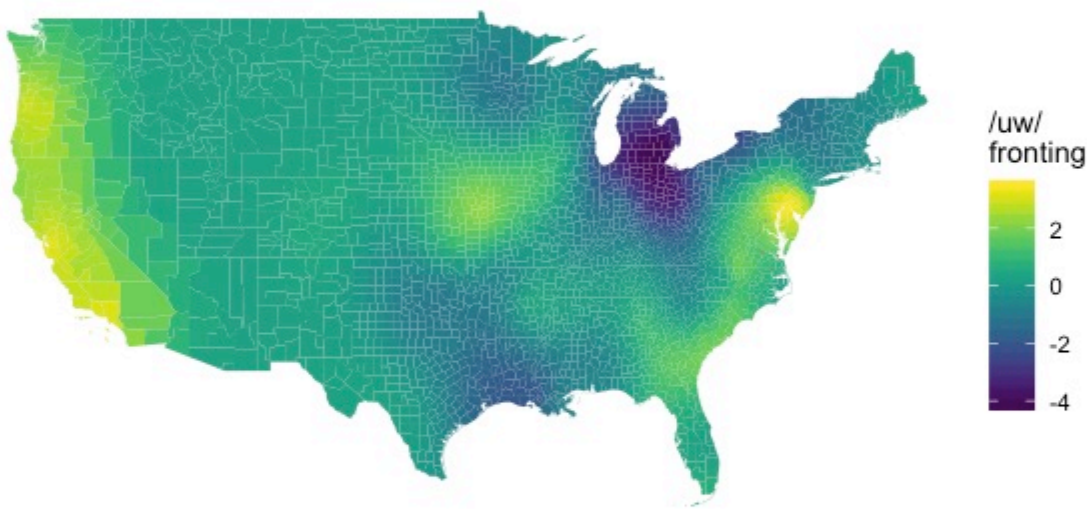


Figure 4.79: Fronting and raising of /uw/ Gi* with 15NN

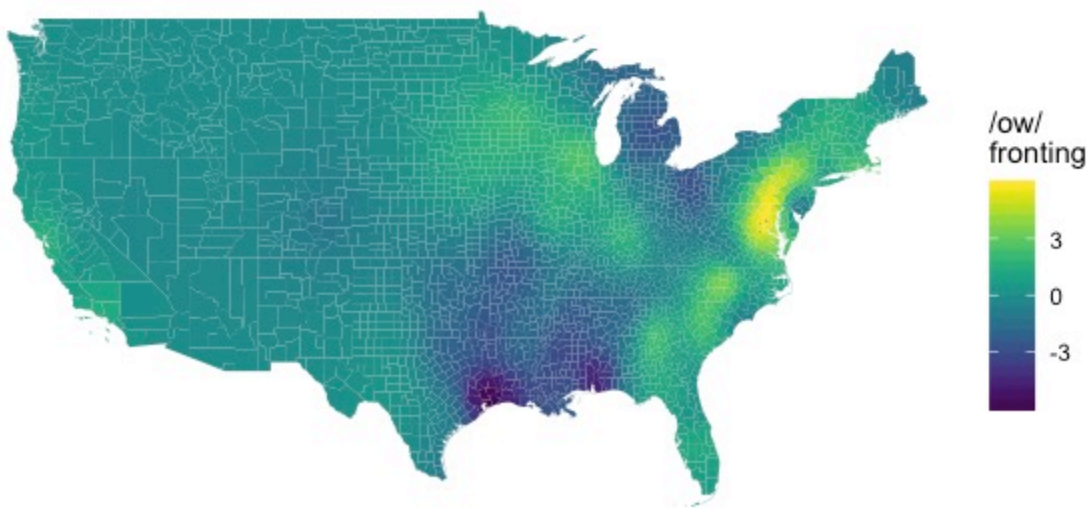


Figure 4.80: Fronting and raising of /uw/ Gi* with 15NN

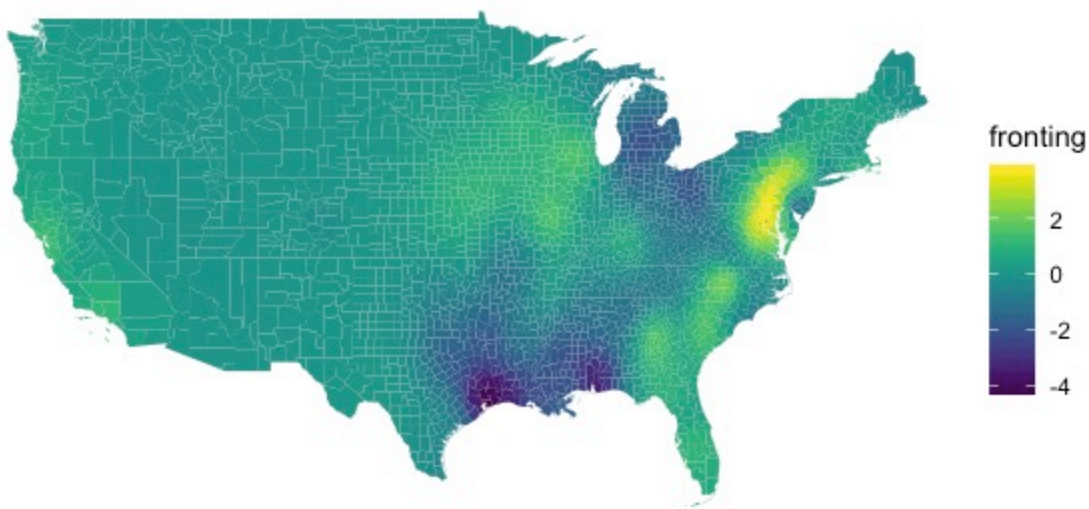


Figure 4.81: Fronting and raising of /uw/ and /ow/ Gi* with 15NN

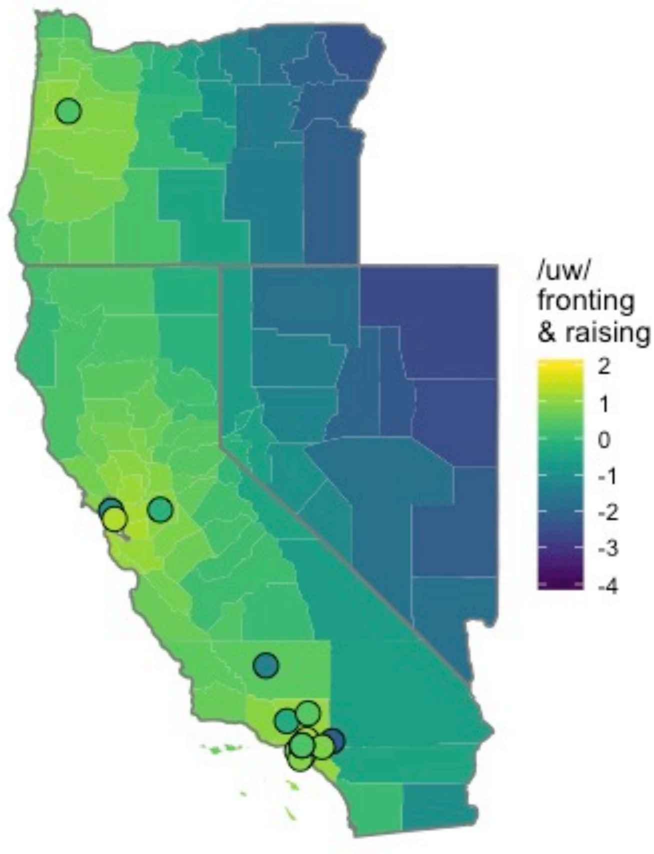


Figure 4.82: Fronting of /uw/ Gi* with 15NN in California

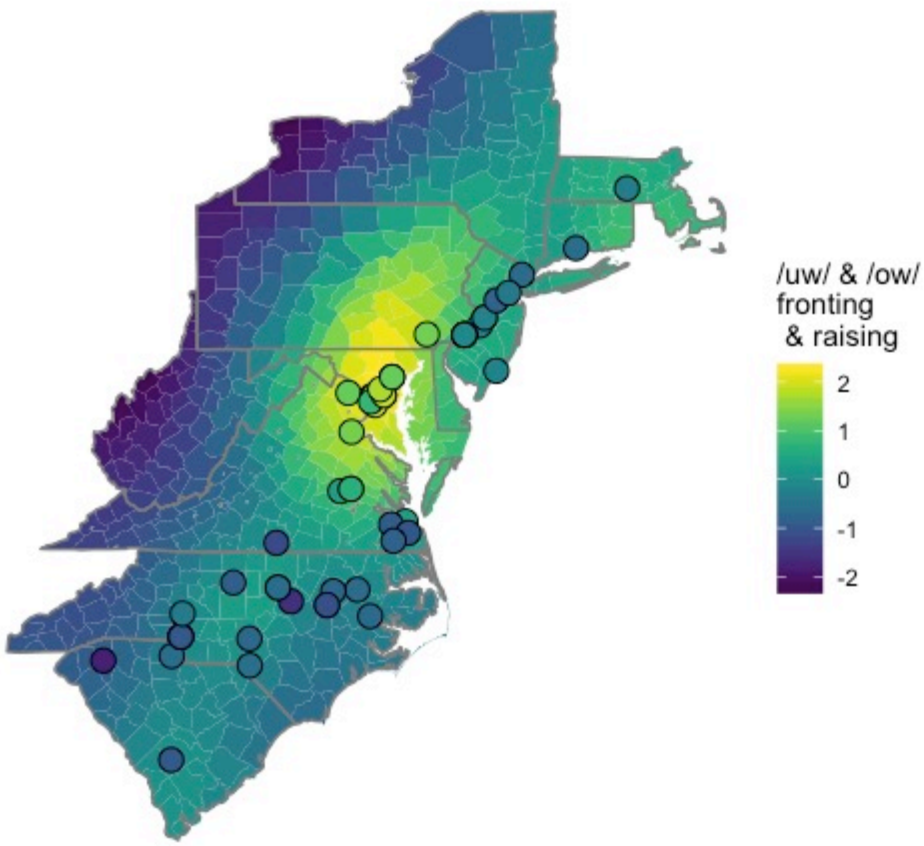


Figure 4.83: Fronting and raising of /uw/ and /ow/ Gi* with 15NN in the Mid-Atlantic

The Back Upgliding Shift

Kriging the Gi* data supports the analysis of the Back Upgliding Shift presented above. The F1 of /aw/ is lowest (that is, the nucleus of the vowel is the most raised) near Atlanta, Georgia (figure 4.2.6). The nucleus of /oh/ is significantly fronted from south to north along the western path of the Mississippi river, this time not including the Gulf, but rising from Arkansas to Wisconsin (figure 4.2.6). It is also noticeably fronter in central Florida, however this is related to the presence of the COT-CAUGHT merger there, whereas the pattern west of the Mississippi is consistent with distinct vowels. The nucleus of /oh/ is significantly lowered along the same corridor, and is significantly raised in the Northeast, especially in New York and Philadelphia, where it is realized as [ʊ͡ɔ] or [u͡ɔ] (figure 4.2.6).

Superimposing these three maps (and inverting the colors for the F1 of /oh/), it is clear the Back Upgliding Shift is strongest in the South, and West of the Mississippi moving as far north as Wisconsin (figure 4.2.6). If we also include back vowels /uw/ and /ow/ that have not raised and fronted, the pattern becomes even stronger (figure 4.2.6). In fact, going by the presence or absence of the back Upgliding Shift and the fronting of back vowels alone, it is possible to distinguish AAE speakers from west of the Mississippi from those on the East Coast.

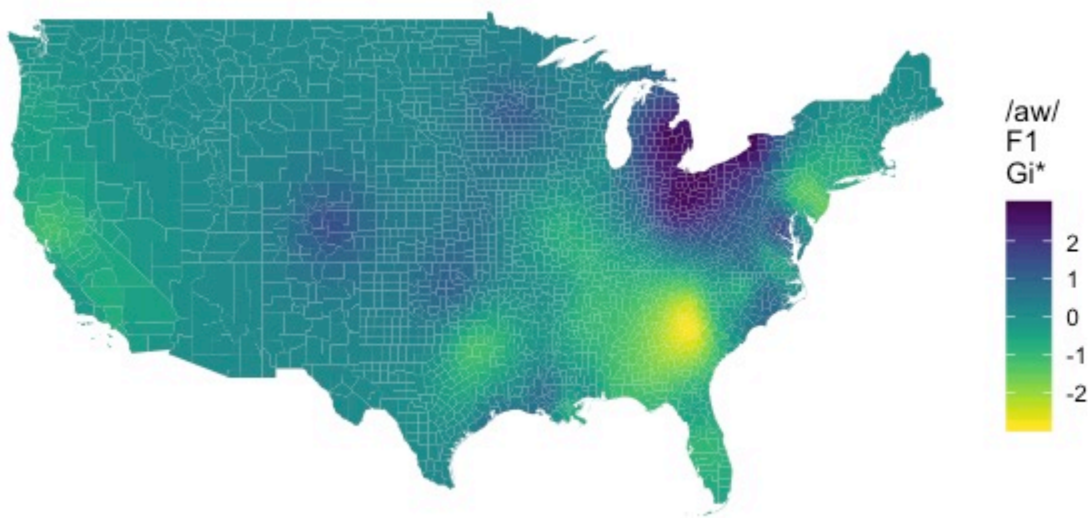


Figure 4.84: F1 of /aw/ Gi* with 15NN

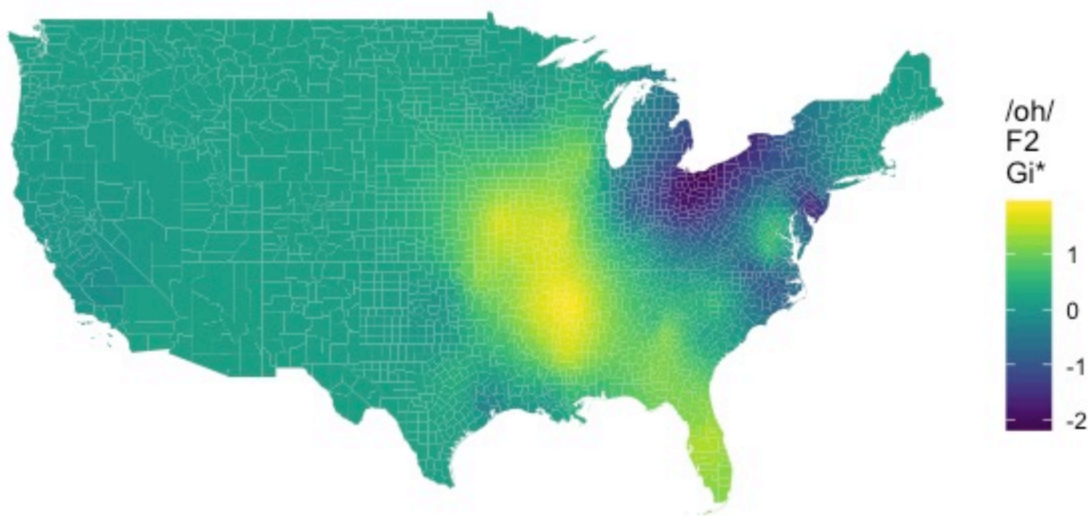


Figure 4.85: F2 of /oh/ Gi* with 15NN

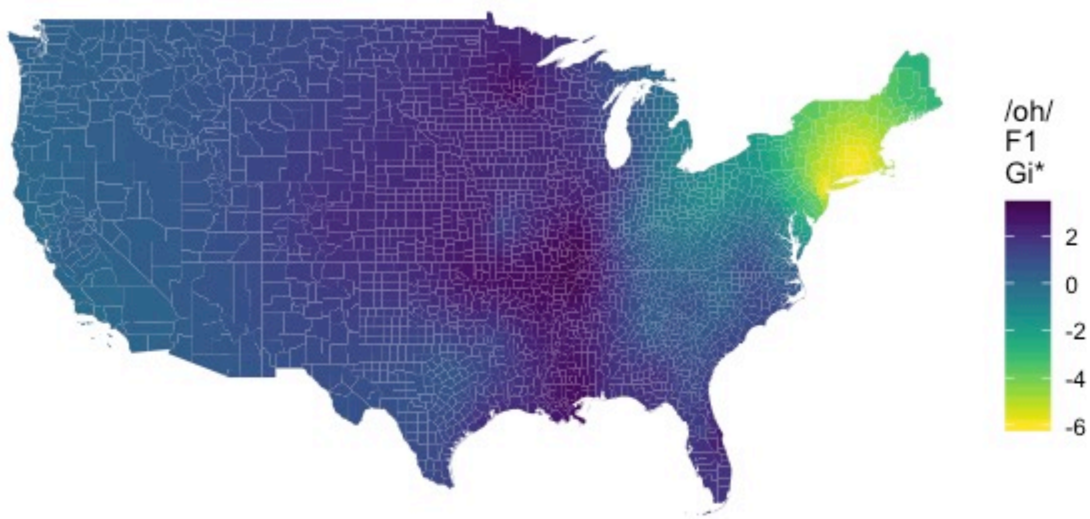


Figure 4.86: F1 of /oh/ Gi* with 15NN

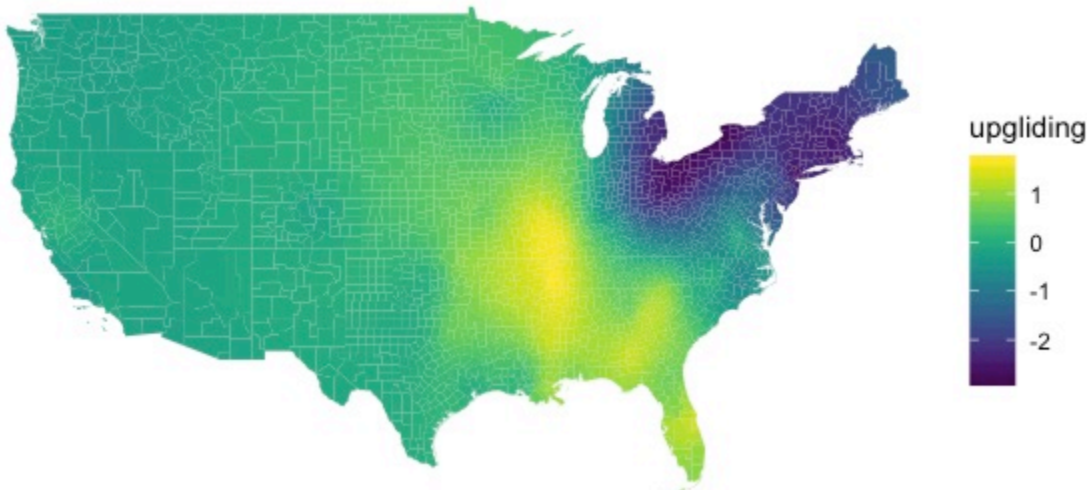


Figure 4.87: The Back Upgliding Shift, Gi* with 15NN

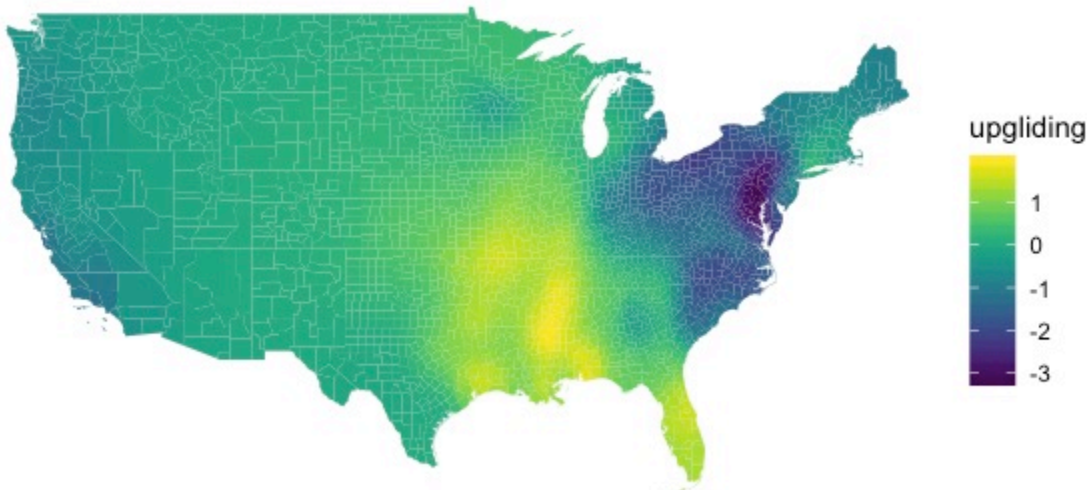


Figure 4.88: The Back Upgliding Shift, with non-fronted /uw/ and /ow/, Gi* with 15NN

Other Patterns

As was discussed above in section 4.2.5, the monophthongization of /ayV/ was effectively universal. While kriging the Gi* data is possible, and creates a map with ostensible hot and cold values, the variation in the raw data is so small that it is effectively a statistical artifact, as the mean value in the raw data for the "high" cluster was 0.877 and the mean value for the "low" cluster was 0.868. As such, I have not included a kriged map here, as it gives the false impression of regional variation where there is none.

Geographic variation in /ayC/, however, was supported by the raw data, and application of the Getis-Ord Gi* statistic, followed by kriging, rendered the spatial component of variation more interpretable. There is a relatively higher degree of monophthongization of /ay/ before voiceless consonants in Michigan and Ohio than elsewhere, and relatively less in The Carolinas and Georgia (figure 4.89). The mean value in the untransformed data for /ayC/ monophthongization in Michigan and Ohio was 0.725, whereas the mean in the Carolinas and Georgia was 0.583 (overall μ: 0.665, σ: 0.16). While it is impossible to rule out the monophthongization of /ayC/ in western New York from these data, as was shown above in figure 4.57, there is no positive evidence for it – rather, extrapolating from the observed data suggests the possibility.

Perhaps the best example of the Getis-Ord statistic and kriging providing insight beyond what is immediately apparent from the raw data is in figure 4.90). The low back vowels are merged in Florida, as expected from the discussion above (figure 4.91). There is also, however, a band of moderately high values moving up the western side of the Mississippi from Louisiana to Wisconsin, which is particularly prominent around Kansas City and St. Louis. Examining plots of the back vowels (excluding those with a following /r/ which is associated with raised /oh/), it becomes apparent that Kansas City and St. Louis AAE speakers exhibit a near-merger (figure 4.92). This would not have been apparent from the raw data, and was not as readily apparent from the Gi* point maps.

The low vowels /oh/ and /æ/ exhibited complicated regional patterns of movement. To better facilitate visualization, of these regional patterns I constructed bivariate choropleth plots. Figure 4.93 plots the F1 and F2 of /oh/. The color grid in the legend is arranged with a standard vowel plot in mind: the farther right on the color grid indicates a lower F2, and the farther left indicates a higher F2. Similarly the higher on the color grid, the lower the F1 (and therefore the higher the vowel). So white cells represent a nucleus of /oh/ closer to [æ] (as with pronunciations like [hæ͡ok] or [hæ͡ɔk] for *hawk*), teal is closer to a nucleus of [ɔ], and violet is the stereotypical New York [u͡ɔ] (as in [hu͡ɔk] for *hawk*). As is clear from the map, lowering and fronting (consistent with the Back Upgliding Shift) is prevalent up the path of the Mississippi River, especially on the western side. Raising of the nucleus of /oh/ is dominant in the Northeast, especially around New York City and Philadelphia. The West Coast exhibits some raising, but not the extreme raising and backing of the Northeast.

Simlarly, /æ/ is implicated in a number of shifts rather than one change (e.g., as described as part of the AAVS). The literature on the AAVS suggests that /æ/ is raising along the periphery (towards [e͡ɪ]). However, this is not universally borne out in these data (4.94). Rather, in some places, like Atlanta, it is raising and laxing (toward [ɛ]. And in both California and parts of the East Coast, the nucleus of /æ/ is backing, toward [ɑ] (consistent with King 2016). Perhaps most interesting is the fact that there is a clear relationship between figures 4.93 and 4.94: moving northward from the Gulf states, up both sides of the Mississippi, but more on the western side, the nucleus of /oh/ is fronting and lowering toward [æ] and the nucleus of /æ/ is raising toward [e͡ɪ], suggesting a push-chain consistent with the Back Upgliding Shift, but moving one step further.

Lastly, kriging the Gi* data reveals the lowering of /u/, toward [ɑ] along the Gulf from East Texas to Gulfport, Mississippi, upward to Atlanta and the inland portion of the Carolinas (4.95).

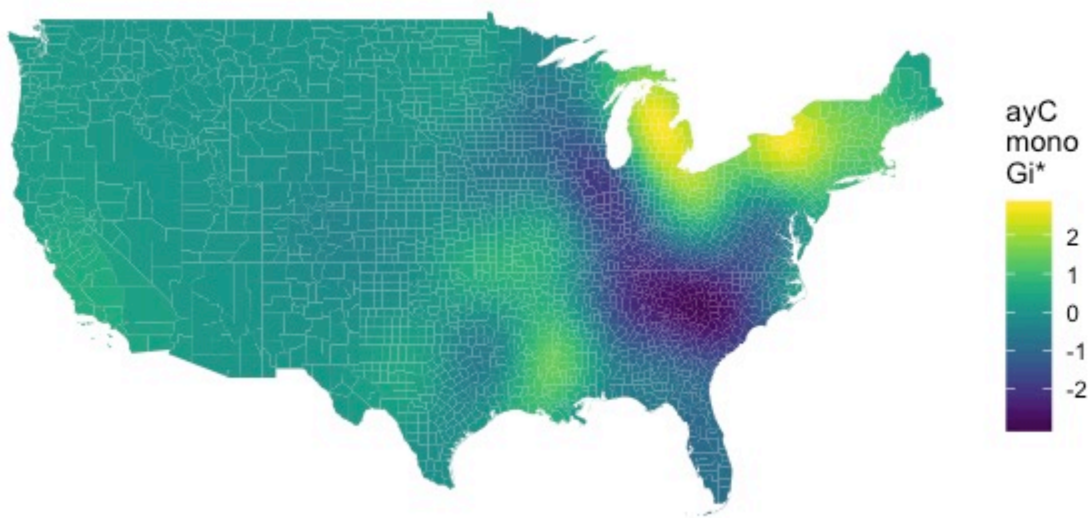


Figure 4.89: Monophthongization of /ayC/ Gi* with 15NN

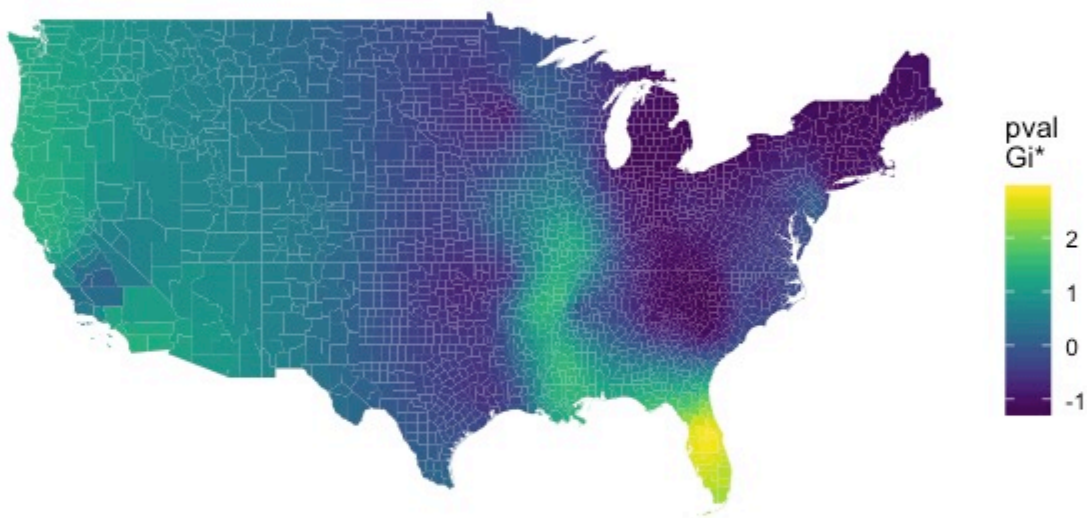


Figure 4.90: COT-CAUGHT merger p-value Gi* with 15NN

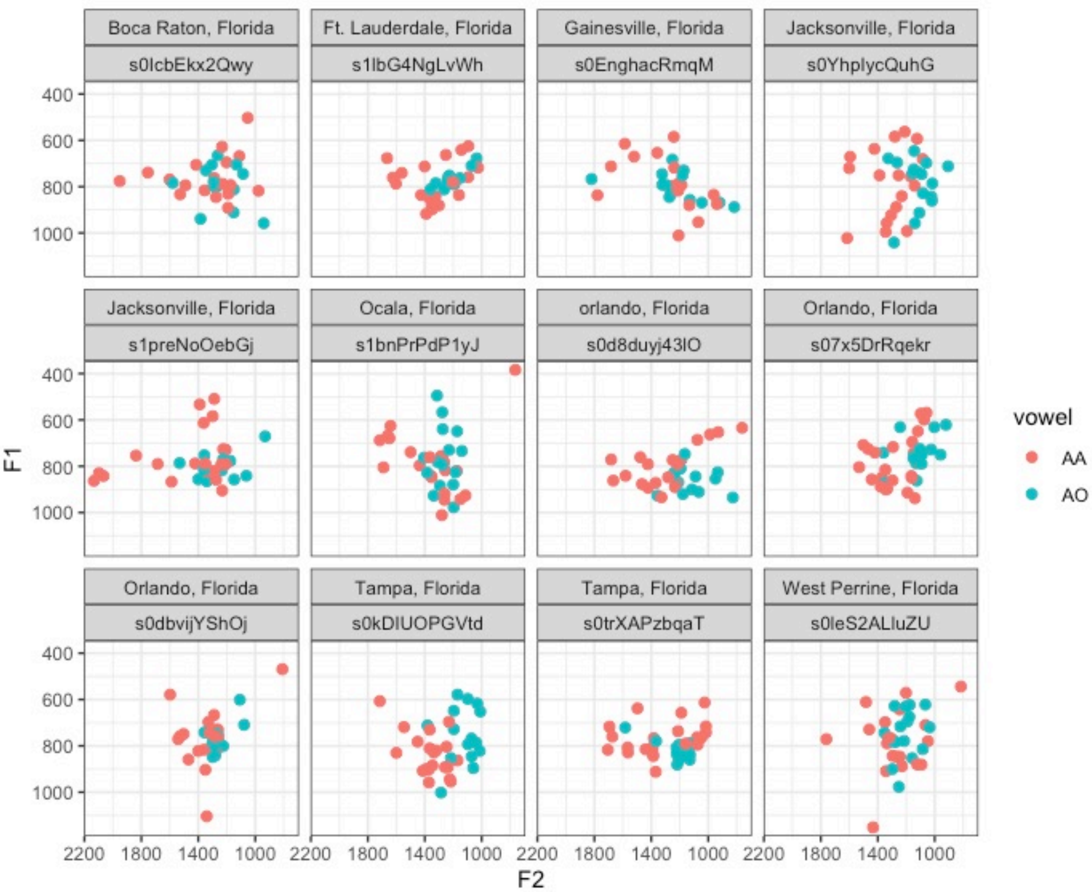


Figure 4.91: COT-CAUGHT merger in Florida

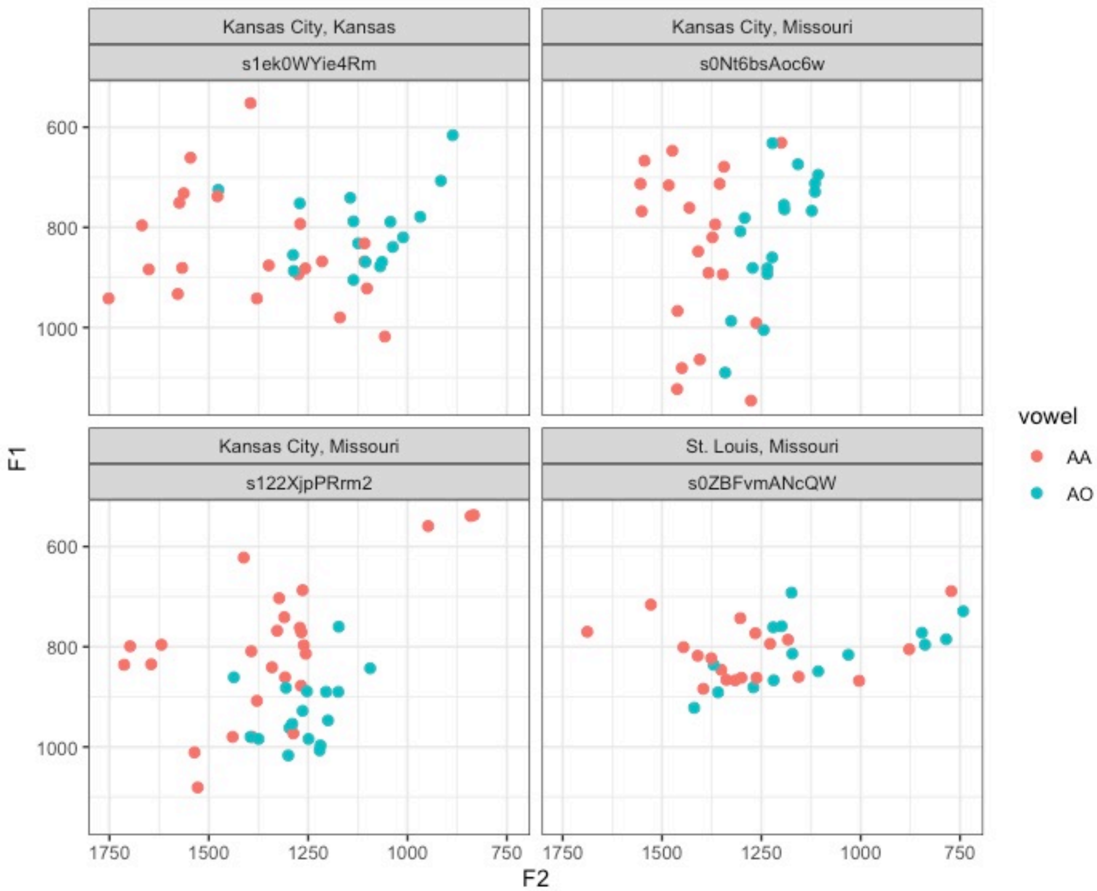


Figure 4.92: COT-CAUGHT near merger in Missouri and Kansas

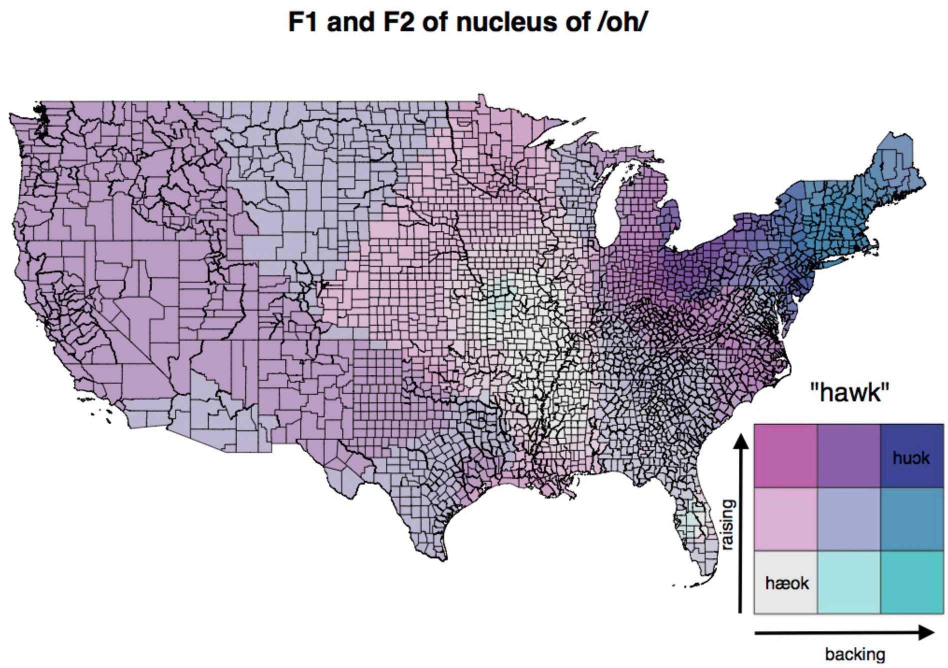


Figure 4.93: Bivariate choropleth of the nucleus of /oh/

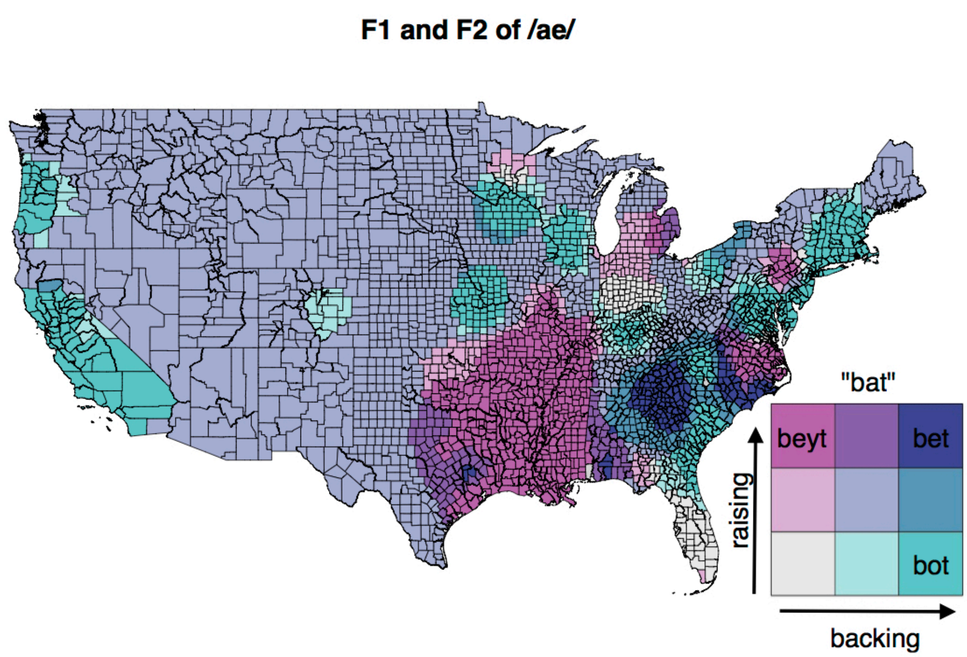


Figure 4.94: Bivariate choropleth of the nucleus of /ae/

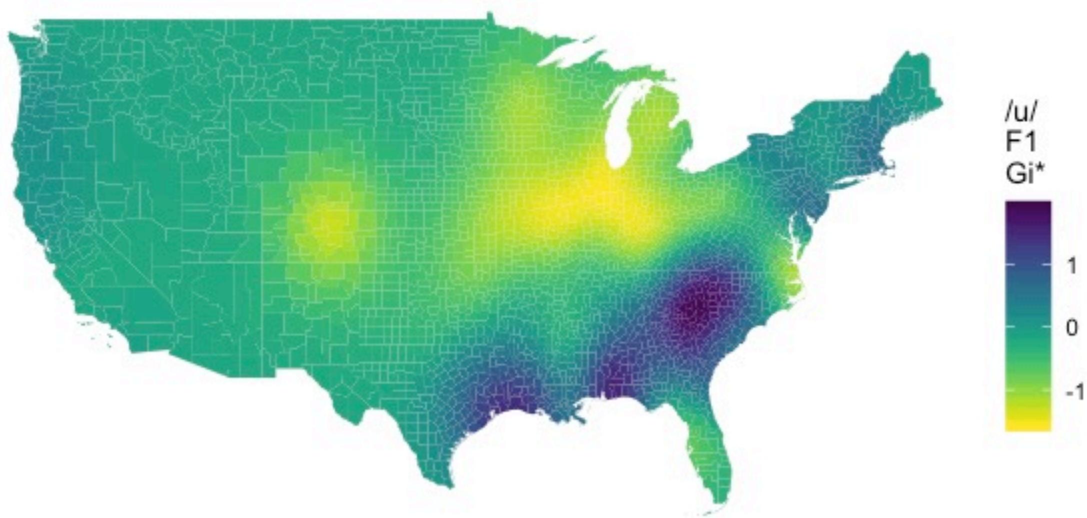


Figure 4.95: F1 of /u/, Gi* 15NN

4.3 Discussion

The above represents the first ever systematic investigation of African American English accents on a national scale. While I envision this as a starting point for a great deal more necessary future research, it has begun to answer the three research questions posed at the beginning of this chapter.

1. Is there regional variation in AAE or is it homogeneous?

It is clear from the above, without a doubt, that there is regional variation in AAE accents. Other research clearly demonstrates that there are regional patterns to AAE lexical choice ranging from pronunciation of common words like *nothing* (Jones, 2015b) to enduring localisms ('*homegrown flavor*') like Washington D.C.'s *bama* '(Southern) rube, simpleton'. There is still other evidence that use of AAE-specific grammatical features is becoming increasingly regionally differentiated (see, e.g., Bailey and Maynor 1989 on habitual *be*, Jones et al. 2019 on the PIN-PEN merger and *be done* constructions). While AAE was first described as, and is used as a textbook example of an *ethnolect*, increasingly there is evidence that it exhibits significant regional variation in the lexicon, syntax, and phonology.

The regional variation in accents shown above emerged without the subjective decision-making by the researcher that troubled the authors of the ANAE. Rather than dividing the raw data into classes based on a theoretically motivated framework, by, say, choosing a specific value in Hertz as cutoff for frontness or backness, I employed contemporary geostatistical methods to evaluate to what extent speakers' mean values for a given vowel formant cluster together geographically. For these clusters, 'hot' and 'cold' corresponded to relative frontness or height. This has the benefit of allowing regional patterns to emerge from the data themselves, rather than allowing subjective decision-making to potentially obscure interesting findings. However, the drawback to this approach is that it can require more interpretation. The same is true of kriging. Kriging to interpolate values provides the best unbiased linear estimate of intervening values based on the observed data, but can also lead us to expect vocalic patterns that are not supported by the data in this sample. It is worth remembering that only seven of the raw formant measures exhibited sufficient spatial variation to allow kriging of the raw data. This may be because AAE does not exhibit as much spatial variation as the European American varieties mapped in the previous chapter, or it may be simply a result of a sample that was half the size of the ANAE sample. Regardless the reason, we can still be confident that the regional patterns that emerge after the application of the Getis-Ord Gi* transformation are not only valid, but emerge from the data themselves.

Given that there is regional variation, the second question is then:

2. Does that variation pattern with the variation described in the ANAE?

As was shown above, the regional variation in AAE does not pattern with the regional variation in European American English as described in the ANAE, at all. The vast majority of the regional variation in AAE is orthogonal to that in EAE, and can be broadly split into the Northeast, the Southeast, the North Midlands, the Mississippi river delta from the Gulf States to the Great Lakes, and the West Coast. AAE speakers in the northern cities do not exhibit the Northern Cities Vowel Shift (nor do AAE speakers anywhere else). AAE speakers in Philadelphia do not reliably participate in the Philadelphia split-æ system (Labov and Fisher, 2015). AAE speakers in California are not reliably COT-CAUGHT merged, and especially not before nasals.[5] While AAE speakers in the South do participate in elements of the Southern Vowel Shift, the geographic pattern is not the same as with European American English, and extends well into the Midlands and the North. The same can be said of the Back Upgliding Shift, which has an additional element for many AAE speakers (the raising

[5]There are insufficient tokens in this sample to demonstrate this. Anecdotally, California AAE speakers retain [ɔ] or even [u͡ɔ] before nasals. This has been confirmed by other linguists working on California AAE (Steven Gilbers, p.c.). The conditioned behavior of /oh/ in California AAE is a topic for future study.

of /æ/ along the peripheral track, toward /ey/). The fronting of the back upgliding vowels (/uw/, /ow/, and /aw/) also does not pattern with European American English variation, and instead is found up and down the East Coast. In fact, comparing the maps in this chapter to those in the previous chapter, it becomes apparent that *for no vowel does the geographic variation in AAE pattern with that in EAE.*

The final question, then, is:

3. Does the proposed African American Vowel Shift (AAVS) accurately characterize AAE? Can regional variation be characterized solely in terms of the AAVS?

As was demonstrated above, the AAVS is very much a real phenomenon. The reversal of /ey/ and /e/, fronting and raising of /æ/, raising of wedge, and occasional fronting of /o/ is present for most of the speakers in this sample from North Carolina (figure 4.96). However, it has been suggested it may be universal in AAE (Bailey and Thomas, 1998). In the sample used here, it is not universal, but rather, a broad pattern moving upward from the Gulf to the Great Lakes following the Mississippi river, and another pocket in the inland Carolinas. Elsewhere, it is not present at all – especially in the mid-Atlantic and Northeast, where it may be perceived as "talking *bama*." It's absence in the mid-Atlantic and Northeast is confirmed by existing corpora such as CORAAL DC and the Philadelphia Neighborhood Corpus, as well as by previous literature on AAE in the Northeast (e.g., Blake et al. 2009).

Dialect Regions

Given that the AAVS does not, in itself, characterize all of the regional variation in AAE, we may then ask "what dialect regions emerge from the above data?" It may be beneficial to briefly discuss what emerges from the above maps, and what we may expect to see from such algorithms.

First, the AAVS is a specific configuration comprising a series of vowel shifts, that has

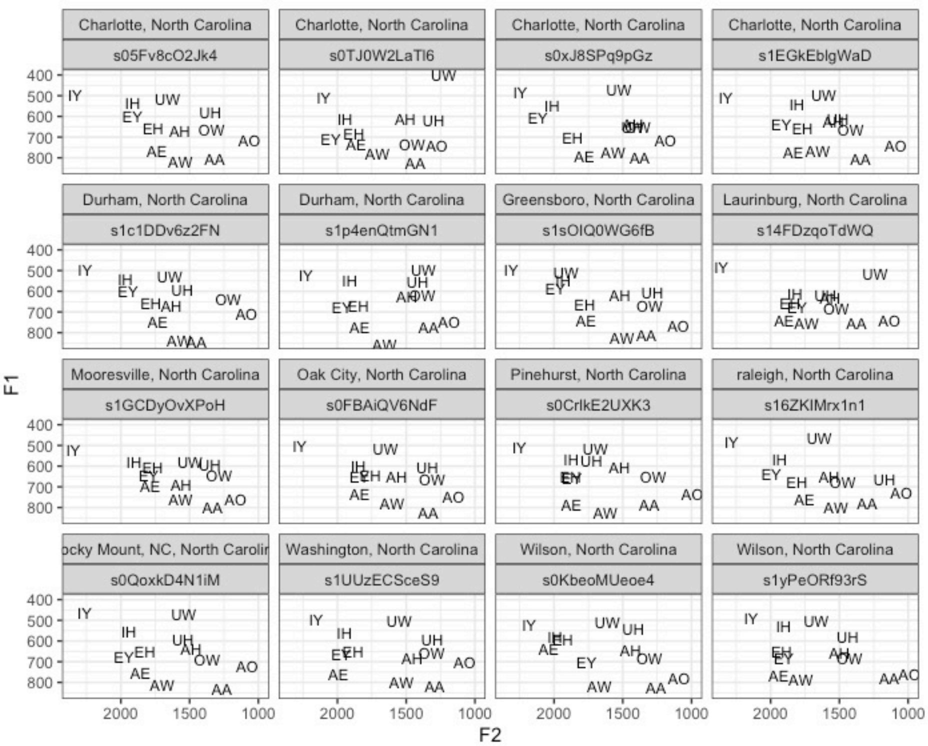


Figure 4.96: Vowel spaces for speakers from North Carolina (arpabet notation).

already been described extensively in the literature on AAE. As was established above, it is broadly present from the Gulf States to the Great Lakes, and in the Carolinas. Including the Back Upgliding Shift, and *excluding* the fronting of /uw/ and /ow/, there is a regional pattern consistent with pathways of movement during the Great Migration up the Mississippi river. The Southeast – Georgia, Florida, and South Carolina – seem to pattern together in their lesser participation in the AAVS, and apparent low-back merger. The Mid-Atlantic and East Coast pattern together in resisting the AAVS and Back Upgliding Shift, with Washington D.C. and Baltimore leading the fronting of /uw/ and /ow/. New York and Philadelphia exhibit a raised, backed nucleus of /oh/, and fronting of /aw/. California exhibits a near merger of the low back vowels, and fronting of /uw/ and /ow/, and backing of /æ/. Lastly, Southern Michigan, Indiana, and Ohio seem to resist most of the shifts previously described.

From the above, it would appear that three main shifts characterize regional variation in AAE: the AAVS, the chain fronting of /uw/, /ow/, and /aw/, and the Back Upgliding Shift (including raising of /ey/), and that participation or lack thereof in each of these shifts results in clear dialect regions in AAE that align with patterns of movement during the Great Migration.

In the next chapter, I employ contemporary statistical methods – both k-means clustering and hierarchical clustering algorithms – to determine what dialect regions emerge from these data without the researcher making subjective decisions about how to divide the data.

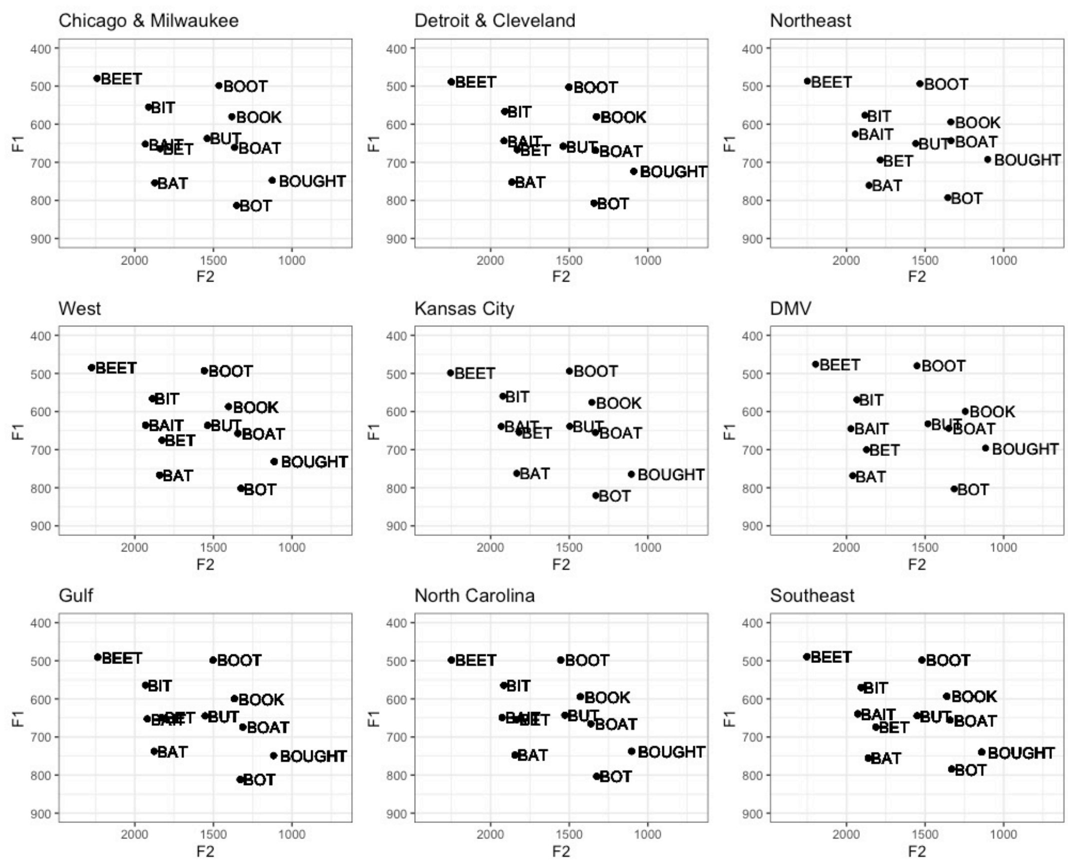


Figure 4.97: Vowel spaces for AAE speakers from different regions

Chapter 5

Clustering Analyses

5.1 Introduction

In the previous chapter, superimposing maps of regional vocalic patterns, especially patterns where we may infer a chain-shift was implicated, resulted in potential dialect regions that meet the criteria put forth in the ANAE (and re-stated in chapter 3). That is, superimposing the maps of all of the vocalic shifts implicated in the African American Vowel Shift resulted in a clear regional pattern in the data. Similarly, the Back Upgliding Shift and chain fronting of back vowels seemed to be implicated in clear regional patterns. Using these patterns alone, it is possible to argue for a number of dialect regions in AAE.

The goal of this chapter is to allow the data to speak for themselves. There are clear patterns that emerged in the previous chapter, using the Gi* statistic – using traditional sociolinguistic and dialect geography methods we can tell a convincing story about what we see in the data, just superimposing the maps. However, there is a chance that because we *expect* the Great Migration to shape the outcomes, because we expect the vocalic patterns associated with the AAVS to shape outcomes, and because researcher decision-making affects what the resulting maps look like (by our choice of what to include or exclude), we may inadvertently allow researcher bias to shape our interpretation of the data.

Unsupervised clustering algorithms allow the data to speak for themselves, albeit with a caveat: they will find whatever number of clusters we impute. Therefore, we use various goodness-of-fit measures, and multiple clustering algorithms. Comparing the results of these algorithms with the theoretically informed groupings suggested in the last chapter, we can either further confirm, or begin to challenge the narrative that began to emerge in the last chapter: that regional variation in the vocalic system of AAE patterns with movement of people during the Great Migration.

Below, k-means clustering and (agglomerative) hierarchical clustering analysis (HCA) are employed. Both methods found geographically meaningful clusters in the absences of direct geographical data.That is, given *only* vocalic data, the resulting clusters exhibited strong spatial patterns. Goodness-of-fit statistics for both suggested similar numbers of optimal clusters, although both effectively found more clusters than would be reasonable for our purposes – picking out individual cities, for instance.

For each of the clustering algorithms discussed below, unless otherwise noted, the Gi* estimates using 15 nearest neighbors for each vowel's F1 and F2 and the Pillai statistic for mergers were used. No other information (e.g., location information, age, gender, etc.) was used in clustering. Euclidean distances were used, after scaling. For both, analysis was performed and visualized in R.

5.1.1 Determining Optimal Clusters

Because both k-means clustering and hierarchical clustering are unsupervised clustering algorithms, determining the optimal number of clusters (in k-means clustering) or the optimal number of sub-trees to consider (in hierarchical clustering) is required – whatever number of clusters we choose to evaluate such that $k \leq n$ where n is the number of observations, both methods will produce that many clusters. Three commonly used methods are employed here: the elbow method, the silhouette method, and the gap statistic.

The elbow method is the oldest, and is conceptually the easiest measure of goodness of fit. The elbow method treats the percent of variance explained as a function of the number of clusters, and seeks to maximize the explained variance with the minimum number of clusters (Thorndike, 1953). In practice, this means looking for an 'elbow' or sharp turning point in a graph of variance explained by number of clusters. This method is also commonly used to evaluate the results of Principal Components Analysis.

The silhouette method (Rousseeuw, 1987) provides a measure of comparison of both tightness and separation of clusters. The result is that it shows which objects lie well within their clusters, and which are "merely somewhere between clusters." The statistic provides a values between -1 and 1, with high values indicating an observation is nearer to others in its cluster but not with those assigned to other clusters.

The Gap Statistic uses the output of any clustering algorithm (e.g., k-means or hierarchical clustering as used below), and compares the change in within-cluster dispersion with the expected under an “appropriate” reference null distribution (Tibshirani et al., 2001).

All three measures were used for both of the clustering algorithms employed below. The results are discussed below.

5.2 K-Means Clustering

K-means clustering is an unsuperivised machine learning algorithm for partitioning data into groups (“clusters”). The given a number of clusters k, the algorithm optimally partitions the data, assigning each observation to a cluster such that the within-group sum-of-squares is minimized (Steinhaus, 1956; Lloyd, 1982; Flach, 2012). That is, given a number of clusters, each observation will be assigned to one of the clusters. For this reason, determining the optimal number of clusters is a first priority.

Turning first to an elbow plot (figure 5.1), there is no clear pivot in these data, however there are a few points of interest. First, there is a slight rise in variance between 7 and 8 clusters. There is a drop after 10, and downward trend to between 17 and 20. Each of these points ($k \subset \{7, 8, 10, 17, 20\}$) may be worth investigating.

A silhouette plot suggests 20 clusters (figure 5.2).

The gap statistic suggests finds 17 clusters are optimal (figure 5.3).

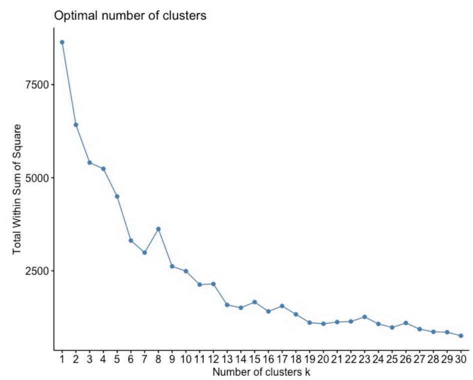


Figure 5.1: Elbow plot for k-means clustering

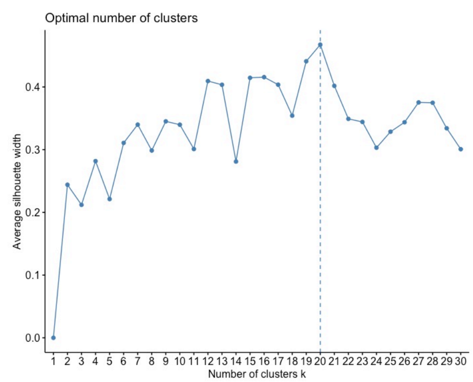


Figure 5.2: Silhouette plot for k-means clustering

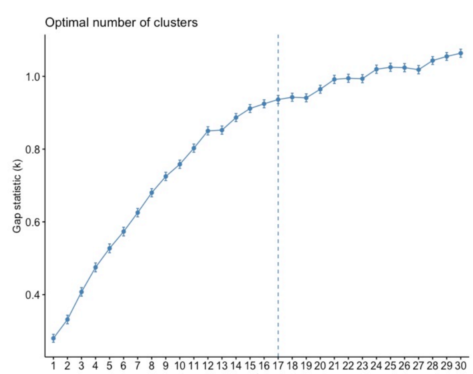


Figure 5.3: Gap statistic plot for k-means clustering

5.2.1 Results

For each of these measures of optimal number of clusters, a relatively high number of clusters emerges from the data. Given the fact that the ANAE finds 11 main dialect regions, and given that we have reason to believe that the varieties of English studied in the ANAE have diverged more, over a greater amount of time, and given the pathways of migration during the Great Migration, 17 to 20 clusters seems excessive for AAE at first glance.

However, the results of k-means clustering with 17 and with 20 clusters *are* geographically interpretable.

K-means clustering was performed only on the Gi* transformed vocalic data and measures of merger. That is, it used F1 for all vowel classes, F2 for all vowel classes, and constructed measures like the reversal of /ey/ and /e/ as measured by the /ey/ F1 minus /e/ F1, as well as Pillai scores for vowel classes implicated in previously described mergers (such as /i/ and /e/ before nasals, in the PIN-PEN merger). Given *only* these data, and *not* geographic information (e.g., latitude and longitude, place name, etc.), the results are still highly spatially interpretable.

In figure 5.4, clusters pattern tightly in space, with California (and Oregon) forming a single cluster, the Southern Gulf States forming another, East Texas and Oklahoma clustering together, the Mississippi valley north of Louisiana, up to Illinois forming a single cluster that implicates Kansas City, St. Louis, and southern Illinois. Florida forms its own cluster, as do Georgia and South Carolina. Interestingly, individual cities are picked out using 20 clusters, so we see Minneapolis, Chicago, Detroit, Washington D.C. and Baltimore, Philadelphia, and the greater New York New Jersey area all forming their own clusters.

While the degree of geographic specificity is perhaps too high for the goal of determining broad dialect regions, it is clear this method produces meaningful geographic patterns consistent with what we may expect independently of these data. New York and New Jersey *are* stereotyped within African American culture as speaking differently (not only because

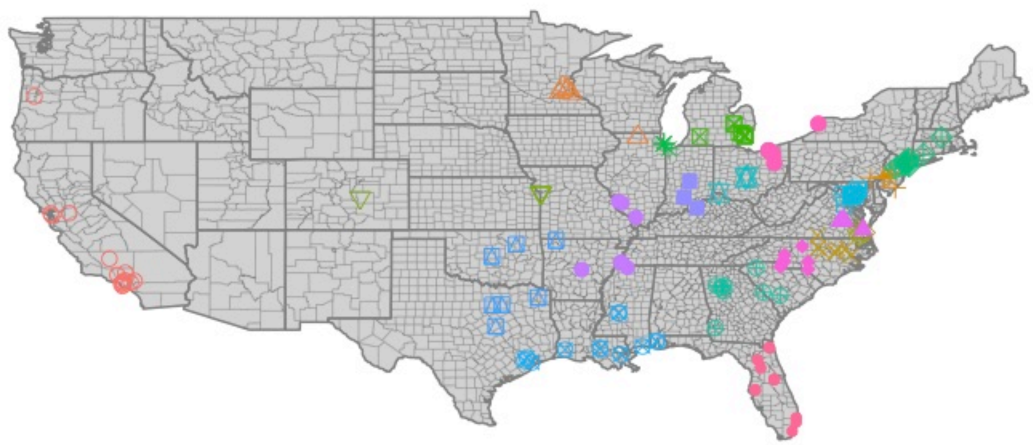


Figure 5.4: Map of k-means clustering with 20 clusters

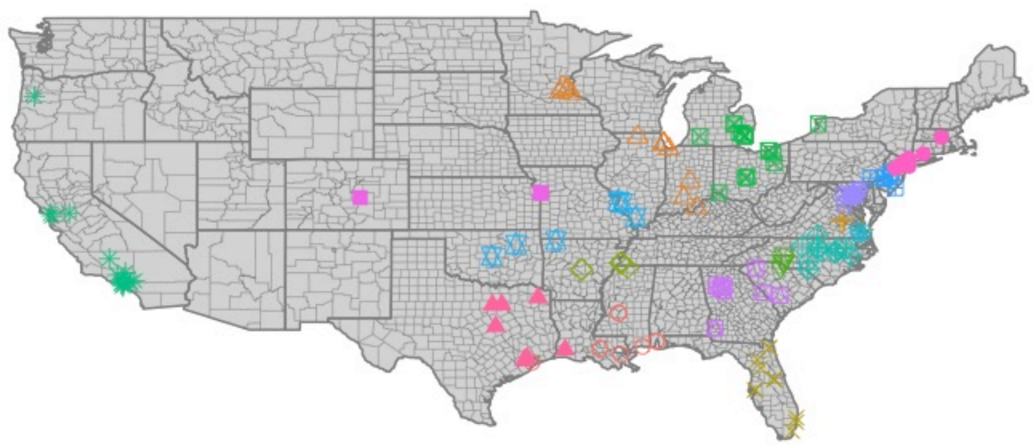


Figure 5.5: Map of k-means clustering with 17 clusters

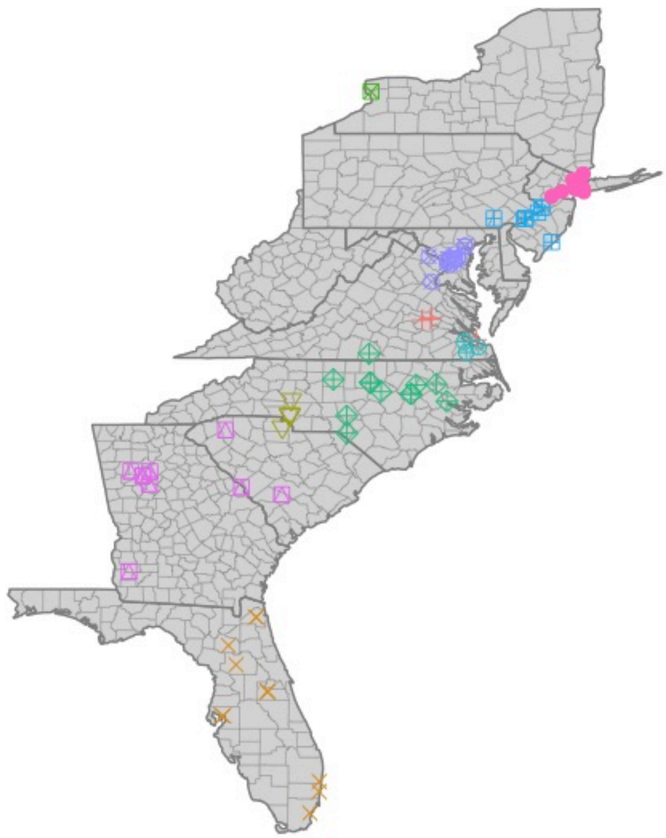


Figure 5.6: Map of k-means clustering with 17 clusters (East Coast)

of their distinction between COT and CAUGHT along with raising of the nucleus of /oh/, but also for things like the fronting of /aw/ that was indicated in the previous chapter. This fronting of /aw/ is not necessarily enregistered as stereotypically New York, per se, but it *is* associated with famous speakers from New York, such as Jay-Z.[1]

Changing the number of clusters results in equally interpretable results. Comparing the results across different numbers of clusters is also informative. Figure 5.5 is the result of k-means clustering with 17 clusters. Here, the results are very similar to 5.4, however there are two interesting phenomena worth noting: first, the points that clustered together in the Gulf have been split into two categories, where *the dividing line is the Mississippi River*. Second, some points now group together that didn't before – most notably the two groups in North Carolina and the three in Michigan and Ohio.

Along the East Coast, individual cities and metropolitan areas are still picked out, with New York (and northern New Jersey) forming one cluster, Philadelphia (and Southern New Jersey) forming another, Washington D.C. and Baltimore[2] forming a third, Virginia Beach forming its own, Richmond, Virginia forming its own, Charlotte, North Carolina on its own, and a wider range of influence extending outward in Georgia from Atlanta (figure 5.6).

Reducing our clusters further, to 10 clusters, still results in spatially interpretable and geographically continuous results. This is not given a priori, and is indicative of a strong regional pattern in the underlying data. The West Coast remains on cluster, Florida remains one cluster, and the East Coast continues to show clusters for individual cities or metropolitan areas (figure 5.7). The main difference here is the northward expansion of the pattern from the Gulf States. Dropping to 7 clusters, New York to Philadelphia are consolidated, Michigan, Ohio, and western New York are consolidated, and the pattern west of the Great Lakes extends further downward toward the Gulf (figure 5.8). North Carolina and the Gulf States

[1] In fact, outside of New York, it seems as though regional accents are not necessarily associated with the place, but rather with famous exemplary speakers – Kevin Hart for Philadelphia, Kanye West for Chicago, etc.

[2] Often called "the DMV" for *District*, *Maryland*, and (northern) *Virginia*.

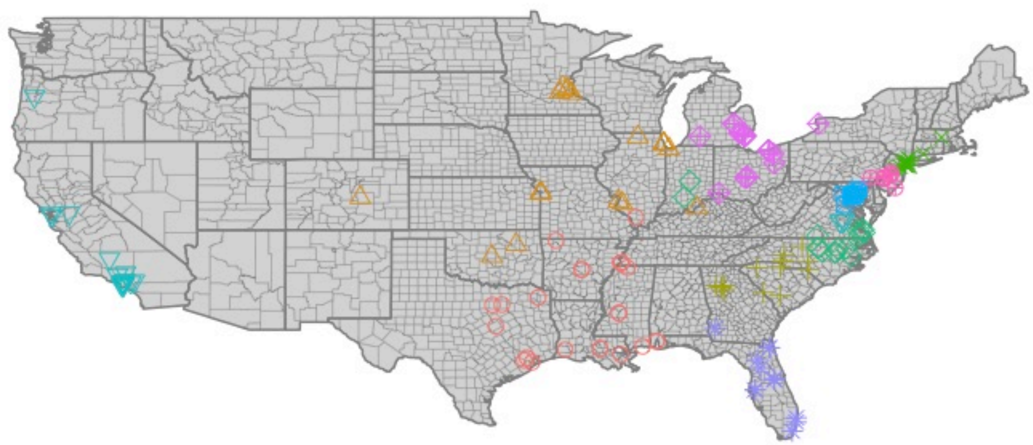


Figure 5.7: Map of k-means clustering with 10 clusters

are now grouped together. These are the same places the AAVS was most strongly apparent in the previous chapter.

Reducing the number of clusters to five, a very clear regional pattern emerges, and it is one that corresponds to folk discussions of AAE dialect regions (figure 5.9). The West Coast remains its own group. Everything from the Gulf States upward to the western part of the Great Lakes region forms its own cluster – consistent with western patterns of the Great Migration. These also group together with North Carolina (consistent with discussion of the AAVS in the previous chapter). Florida, Georgia, and South Carolina – the Southeast – group together. Washington D.C. and Baltimore group together. They also pattern with California, suggesting the main factor the clustering algorithm is picking out is fronting of /uw/ and /ow/. Michigan, Ohio, and western New York pattern together. Lastly, the I-95 corridor from north of Baltimore all the way to Boston patterns together.

Perhaps the most interesting aspect of this map, is the fact that the regions make sense. While California and Washington D.C. have different vowel systems, both exhibit fronting of /uw/ and /ow/. While the band moving up the middle of the country patterns with North Carolina, both are characterized by the AAVS. Moreover, they follow the pattern of movement of African Americans during the Great Migration, including the fact that North Carolina was a destination for some African Americans from the Gulf,[3] despite migration to the Eastern seaboard receiving less scholarly treatment in the literature on the Great Migration (Wilkerson, 2010, pp. 540).

[3]This was discussed at length at NWAV48 by Lisa Green, a native AAE speaker and expert on AAE from Louisiana, and Sarah Philips, a native AAE speaker and expert on AAE whose family is from North Carolina.

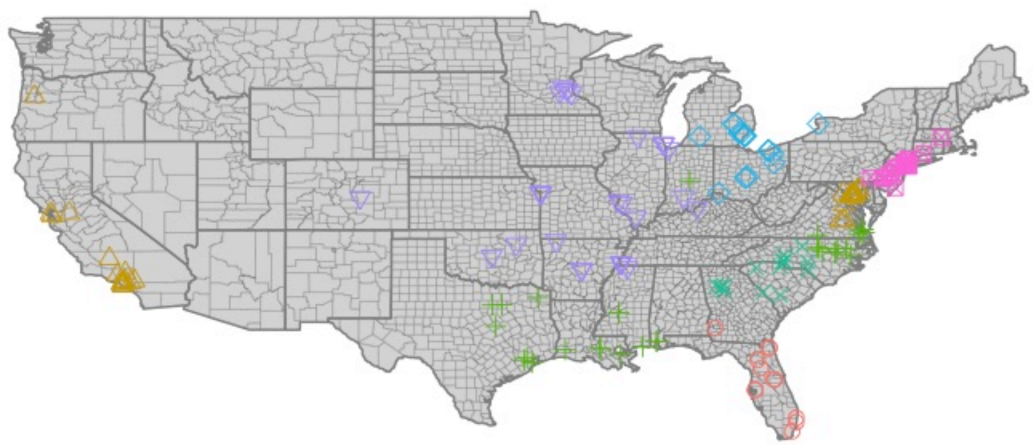


Figure 5.8: Map of k-means clustering with 7 clusters

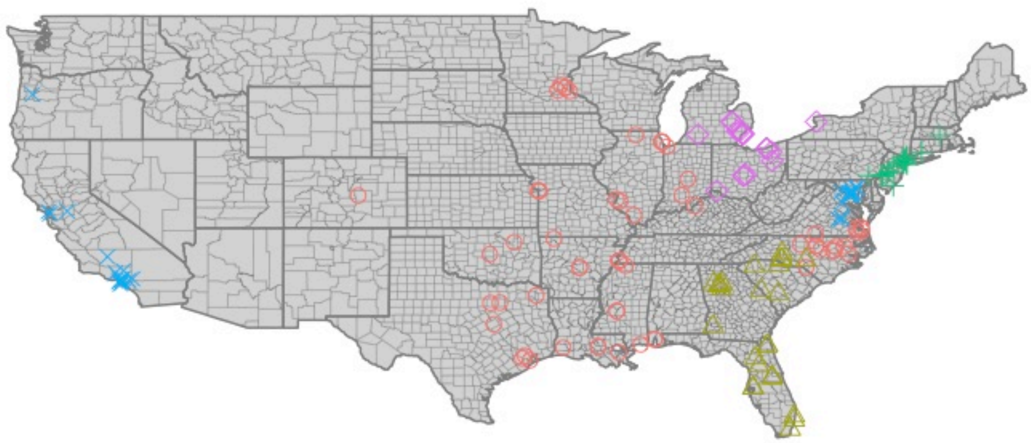


Figure 5.9: Map of k-means clustering with 5 clusters

5.3 Hierarchical Clustering Analysis

Hierarchical clustering analysis (HCA) is an alternative to k-means clustering that does not require choosing a number of clusters in advance. Rather, it groups the data into a tree (often called a dendrogram), which groups more similar observations with each other. There are two main approaches to HCA: agglomerative clustering, also called AGNES, for "agglomerative nesting" and divisive hierarchical clustering, also called DIANA, for "divise analysis." AGNES groups all of the data into the most similar pairs, then groups pairs of pairs, and so on, until a tree is built from the bottom up. DIANA, on the other hand, seeks to first divide the data, then divide the two divisions of the data into the best two divisions each, and so on.

Given the nature of these data – (transformations of) vowel observations for speakers for whom we expect there to be reasonable speech communities – AGNES was the better choice, and was therefore implemented.

There are a variety of possible ways of measuring similarity and dissimilarity between clusters of observations. Comparing the agglomerative coefficient (where a value closer to 1 indicates a better method) for average linkage clustering, single linkage clustering, complete linkage clustering, and Ward's minimum distance variance method, Ward's method was found to identify the strongest clustering structure.

Using agglomerative clustering with ward's method, the elbow method suggests 10 clusters (figure 5.10), the silhouette method suggests 10 clusters (figure 5.11), and the gap

method	coefficient
average	0.82
single	0.75
complete	0.87
ward	0.97

Table 5.1: Agglomerative coefficient by linkage method

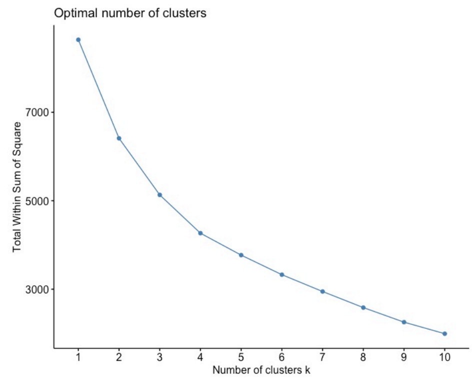


Figure 5.10: Elbow plot for hierarchical clustering

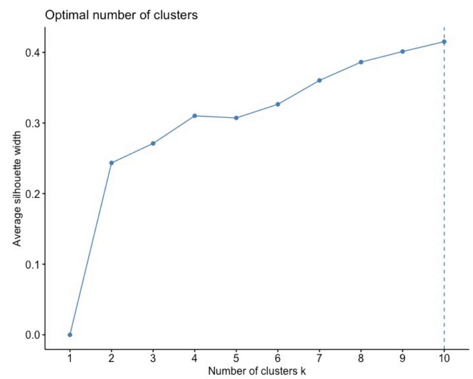


Figure 5.11: Silhouette plot for hierarchical clustering

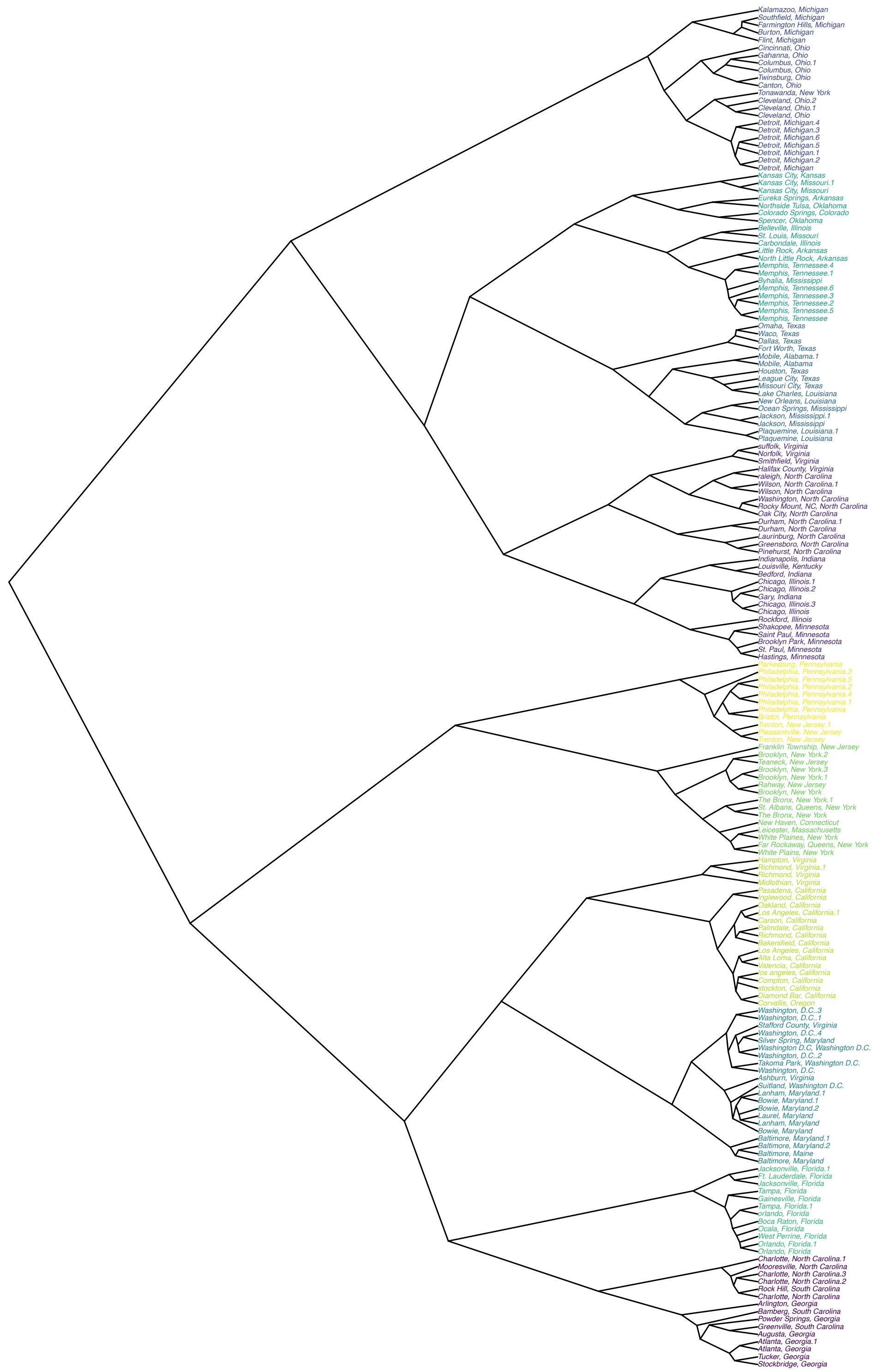
statistic also suggests 10 clusters (5.12).

As such, 10 clusters seems to be the ideal number of clusters to investigate spatially. However, analysis and discussion of the full dendrogram resulting from agglomerative hierarchical clustering will prove informative.

5.3.1 Results

Using agglomerative hierarchical clustering with 10 clusters, again geographically interpretable and socially meaningful patterns emerged. A cluster plot of the results is given in figure 5.13. The full phylogenetic tree is given in radial form in figure 5.14. The a complete cladogram, color-coded for ten clusters, is given on page 247. Examining the dendrogram and its sub-trees, what emerges is geographic clusters that make intuitive sense. For instance, one sub-tree picks out New York City, northern New Jersey, and all sampled speakers north of New York (figure 5.15). Another picks out the Southeast, clustering Florida together with Georgia and South Carolina, with each state forming its own sub-tree (figure 5.16).

Using 10 clusters, there are two patterns that do not immediately make sense. The first is the fact that the clustering algorithm groups California and Oregon with Washington D.C. and Baltimore (figure 5.17). Given the geographic distance and the fact that there is no reason to expect shared origin, these two should be treated as separate clusters. Each of the observations in the West are more similar to one another than to those in the DMV, and the West Coast and DMV separate neatly into two sub-trees. The probable reason for these being grouped together by AGNES is the fact that both exhibit fronting of /uw/ and /ow/, however there is no evidence that this is a shared inheritance and not parallel evolution.


Kalamazoo, Michigan
Southfield, Michigan
Farmington Hills, Michigan
Burton, Michigan
Flint, Michigan
Cincinnati, Ohio
Gahanna, Ohio
Columbus, Ohio.1
Columbus, Ohio
Twinsburg, Ohio
Canton, Ohio
Tonawanda, New York
Cleveland, Ohio.2
Cleveland, Ohio.1
Cleveland, Ohio
Detroit, Michigan.4
Detroit, Michigan.3
Detroit, Michigan.6
Detroit, Michigan.5
Detroit, Michigan.1
Detroit, Michigan.2
Detroit, Michigan
Kansas City, Kansas
Kansas City, Missouri.1
Kansas City, Missouri
Eureka Springs, Arkansas
Northside Tulsa, Oklahoma
Colorado Springs, Colorado
Spencer, Oklahoma
Belleville, Illinois
St. Louis, Missouri
Carbondale, Illinois
Little Rock, Arkansas
North Little Rock, Arkansas
Memphis, Tennessee.4
Memphis, Tennessee.1
Byhalia, Mississippi
Memphis, Tennessee.6
Memphis, Tennessee.3
Memphis, Tennessee.2
Memphis, Tennessee.5
Memphis, Tennessee
Omaha, Texas
Waco, Texas
Dallas, Texas
Fort Worth, Texas
Mobile, Alabama.1
Mobile, Alabama
Houston, Texas
League City, Texas
Missouri City, Texas
Lake Charles, Louisiana
New Orleans, Louisiana
Ocean Springs, Mississippi
Jackson, Mississippi.1
Jackson, Mississippi
Plaquemine, Louisiana.1
Plaquemine, Louisiana
suffolk, Virginia
Norfolk, Virginia
Smithfield, Virginia
Halifax County, Virginia
raleigh, North Carolina
Wilson, North Carolina.1
Wilson, North Carolina
Washington, North Carolina
Rocky Mount, NC, North Carolina
Oak City, North Carolina
Durham, North Carolina.1
Durham, North Carolina
Laurinburg, North Carolina
Greensboro, North Carolina
Pinehurst, North Carolina
Indianapolis, Indiana
Louisville, Kentucky
Bedford, Indiana
Chicago, Illinois.1
Chicago, Illinois.2
Gary, Indiana
Chicago, Illinois.3
Chicago, Illinois
Rockford, Illinois
Shakopee, Minnesota
Saint Paul, Minnesota
Brooklyn Park, Minnesota
St. Paul, Minnesota
Hastings, Minnesota
Parkesburg, Pennsylvania
Philadelphia, Pennsylvania.3
Philadelphia, Pennsylvania.5
Philadelphia, Pennsylvania.2
Philadelphia, Pennsylvania.4
Philadelphia, Pennsylvania.1
Philadelphia, Pennsylvania
Bristol, Pennsylvania
Trenton, New Jersey.1
Pleasantville, New Jersey
Trenton, New Jersey
Franklin Township, New Jersey
Brooklyn, New York.2
Teaneck, New Jersey
Brooklyn, New York.3
Brooklyn, New York.1
Rahway, New Jersey
Brooklyn, New York
The Bronx, New York.1
St. Albans, Queens, New York
The Bronx, New York
New Haven, Connecticut
Leicester, Massachusetts
White Plaines, New York
Far Rockaway, Queens, New York
White Plains, New York
Hampton, Virginia
Richmond, Virginia.1
Richmond, Virginia
Midlothian, Virginia
Pasadena, California
Inglewood, California
Oakland, California
Los Angeles, California.1
Carson, California
Palmdale, California
Richmond, California
Bakersfield, California
Los Angeles, California
Alta Loma, California
Valencia, California
los angeles, California
Compton, California
stockton, California
Diamond Bar, California
Corvallis, Oregon
Washington, D.C..3
Washington, D.C..1
Stafford County, Virginia
Washington, D.C..4
Silver Spring, Maryland
Washington D.C, Washington D.C.
Washington, D.C..2
Takoma Park, Washington D.C.
Washington, D.C.
Ashburn, Virginia
Suitland, Washington D.C.
Lanham, Maryland.1
Bowie, Maryland.1
Bowie, Maryland.2
Laurel, Maryland
Lanham, Maryland
Bowie, Maryland
Baltimore, Maryland.1
Baltimore, Maryland.2
Baltimore, Maine
Baltimore, Maryland
Jacksonville, Florida.1
Ft. Lauderdale, Florida
Jacksonville, Florida
Tampa, Florida
Gainesville, Florida
Tampa, Florida.1
orlando, Florida
Boca Raton, Florida
Ocala, Florida
West Perrine, Florida
Orlando, Florida.1
Orlando, Florida
Charlotte, North Carolina.1
Mooresville, North Carolina
Charlotte, North Carolina.3
Charlotte, North Carolina.2
Rock Hill, South Carolina
Charlotte, North Carolina
Arlington, Georgia
Bamberg, South Carolina
Powder Springs, Georgia
Greenville, South Carolina
Augusta, Georgia
Atlanta, Georgia.1
Atlanta, Georgia
Tucker, Georgia
Stockbridge, Georgia

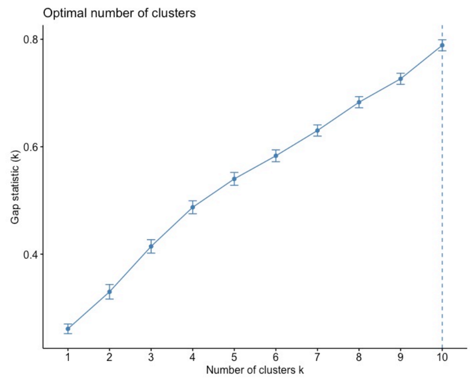


Figure 5.12: Gap statistic plot for hierarchical clustering

Similarly, North Carolina and Southern Virginia are grouped together with parts of Illinois, Indiana, and Minnesota (figure 5.18). Again, these can be easily separated into two sub-trees. In fact, is consistent with the fact that parts of Southern Virginia and North Carolina exhibit the AAVS, and pattern more broadly with the speakers from the Gulf States to the Great Lakes, albeit most similarly with those further north (figure 5.19). Given that North Carolina was both a point of departure for people during the Great Migration *and* a destination, the fact that it patterns with other endpoints of the Great Migration for people from the same starting point – the Gulf – makes intuitive sense.

Figure 5.20 maps the results of dividing the data into ten groups after agglomerative hierarchical clustering.

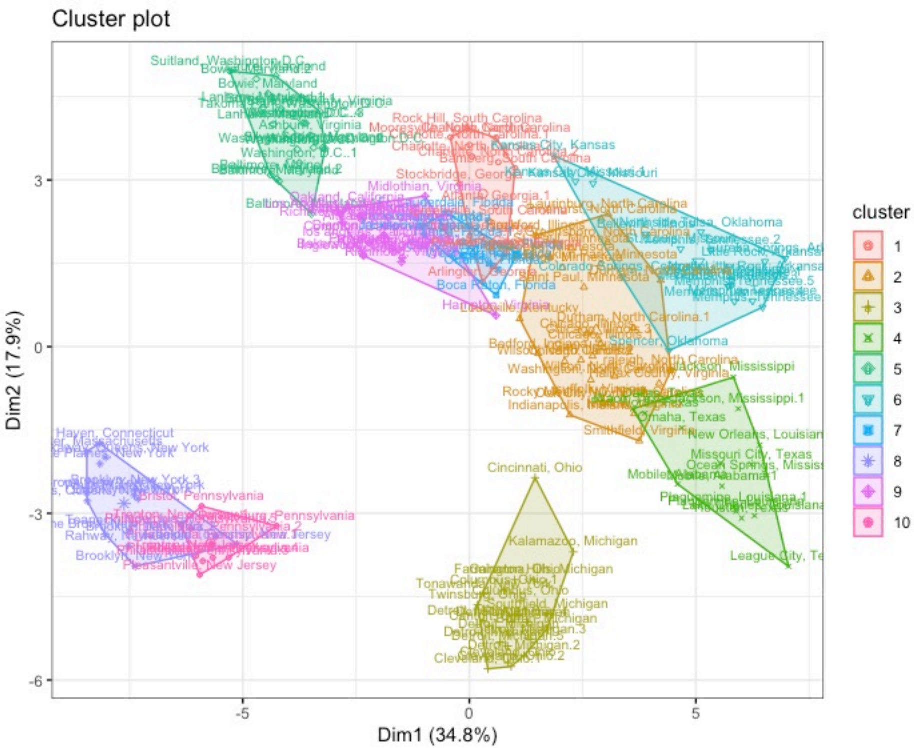


Figure 5.13: Cluster plot of agglomerative hierarchical clustering with 10 clusters

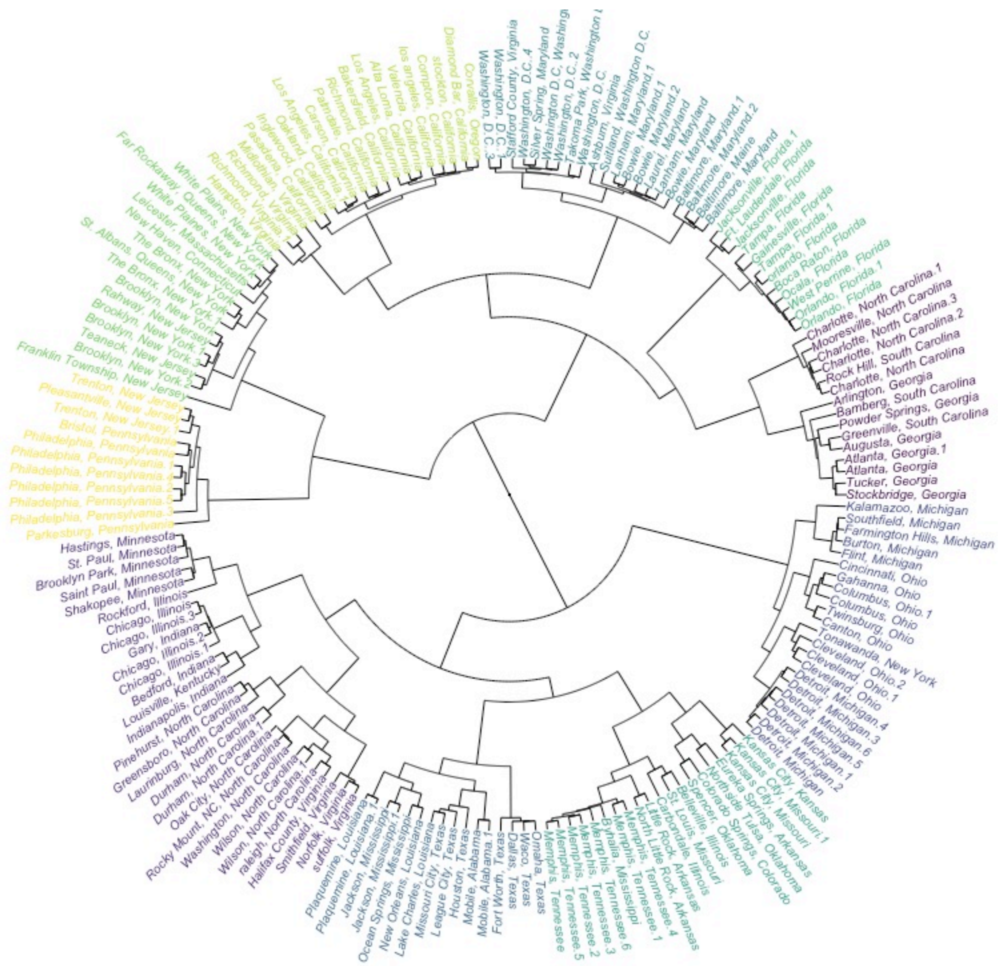


Figure 5.14: Fan plot of agglomerative hierarchical clustering with 10 clusters

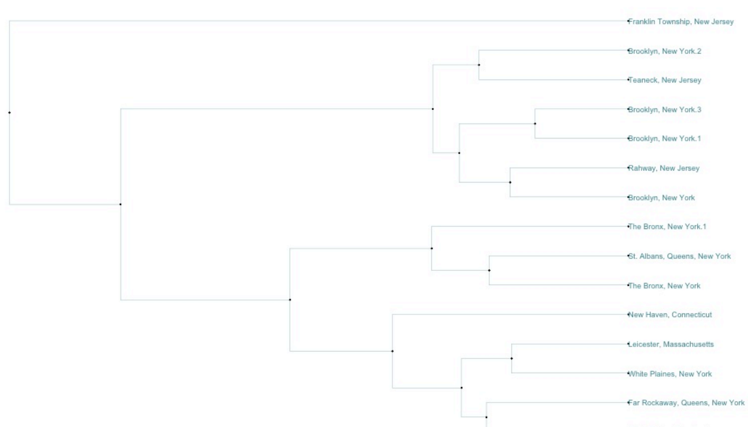


Figure 5.15: The Greater NYC area as a cluster

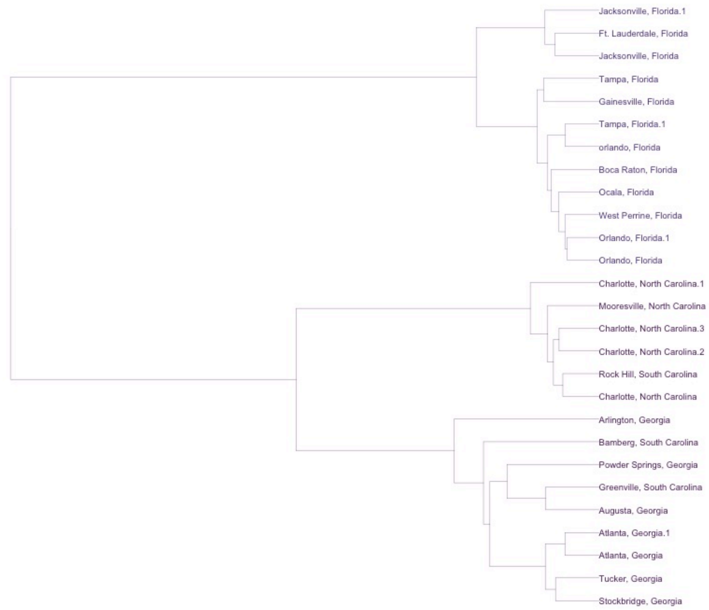


Figure 5.16: The Southeast

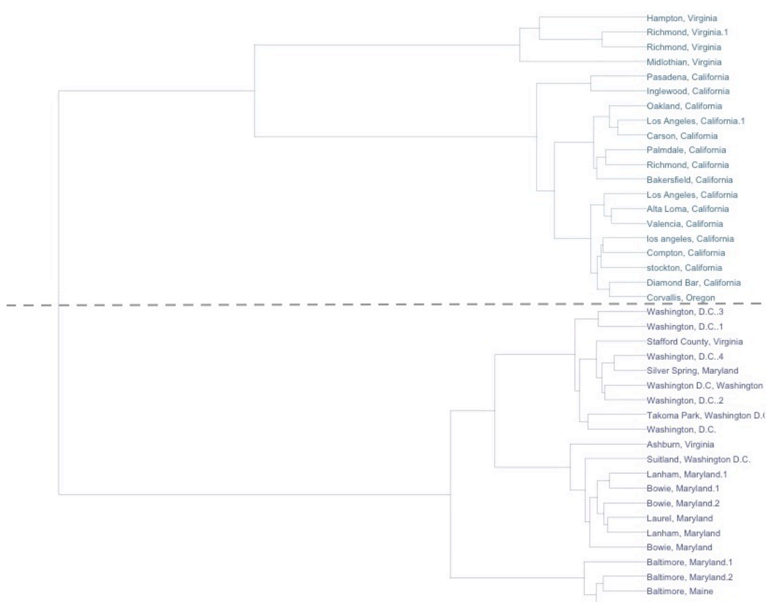


Figure 5.17: California and D.C.

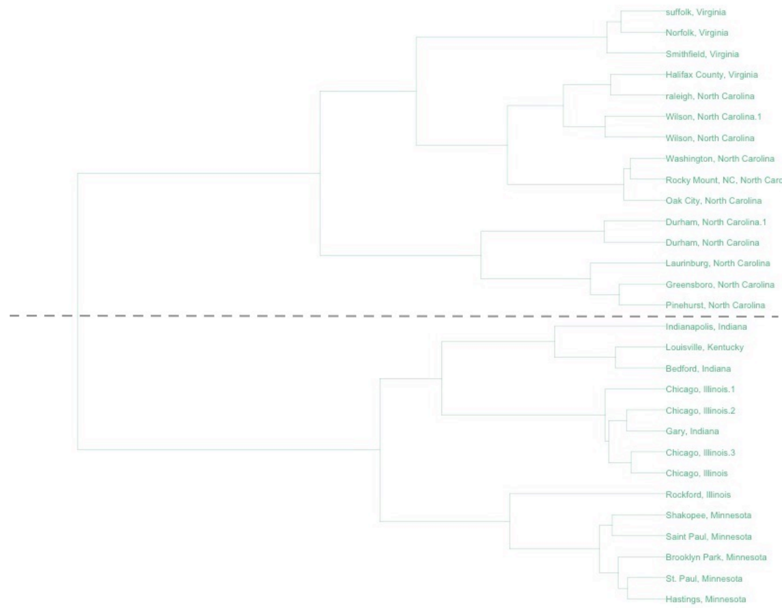


Figure 5.18: North Carolina and Illinois

Figure 5.19: The Western Great Migration and North Carolina

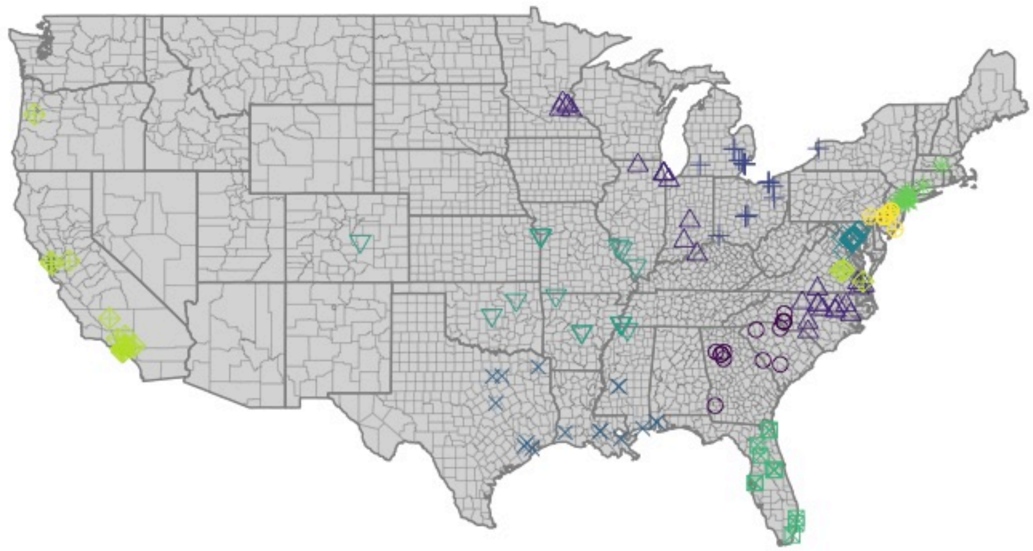


Figure 5.20: Map of 10 clusters from AGNES

5.4 Discussion

The results of using k-means clustering and of using agglomerative hierarchical clustering were similar. Both resulted in clear, geographically and socially meaningful clusters. It should be noted that this is not expected *a priori* from applying clustering algorithms to observed vocalic data, even the Gi* transformed data. While both methods tended toward higher numbers of clusters as "ideal," for the purposes of determining dialect regions in AAE we can also bring to bear findings from the previous chapter, and our knowledge of the Great Migration. The broader patterns of the Great Migration (for instance, those mapped in the *Atlas of African American History and Politics*, figure 5.21), are captured by the broadest patterns in the data, regardless what clustering algorithm is used (for instance, using AGNES, with five clusters, as in figure 5.22, cf. k-means clustering with 5 clusters, figure 5.9).

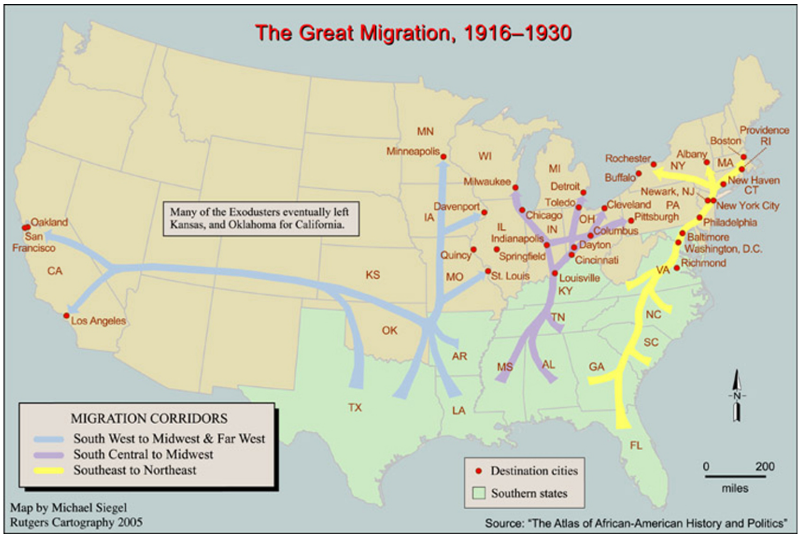


Figure 5.21: Map of the first Great Migration (Smallwood and Elliot, 1998)

Some clusters clearly emerged from specific patterns that may not be related geographically, but are linguistically. For instance, the consistent grouping of the DMV with California. There is little reason to think that AAE speakers from the DMV and from California are one cohesive linguistic population, nor is there much reason to think that they have shared features inherited from an earlier population of AAE speakers. Rather, both exhibit fronting of the back vowels /uw/ and /ow/, which is a common shift cross-linguistically Labov (1994), and which likely developed independently in both populations.

Perhaps one of the most interesting aspects of these findings is that they align with historical patterns from the earliest days of chattel slavery in the United States. No matter the clustering algorithm used, there is a clear division between the Southeast, the Gulf of Mexico, and the Mid-Atlantic, with different vocalic patterns and different patterns of movement during the Great Migration. These align with both the locations of the major slave ports (figure 5.23), and three major populations of enslaved Africans in America in the 1810 census (figure 5.24).

Mapping individual vocalic patterns, as in the previous chapter, or clusters based on unsupervised machine learning methods, as in this chapter, both result in clear, interpretable

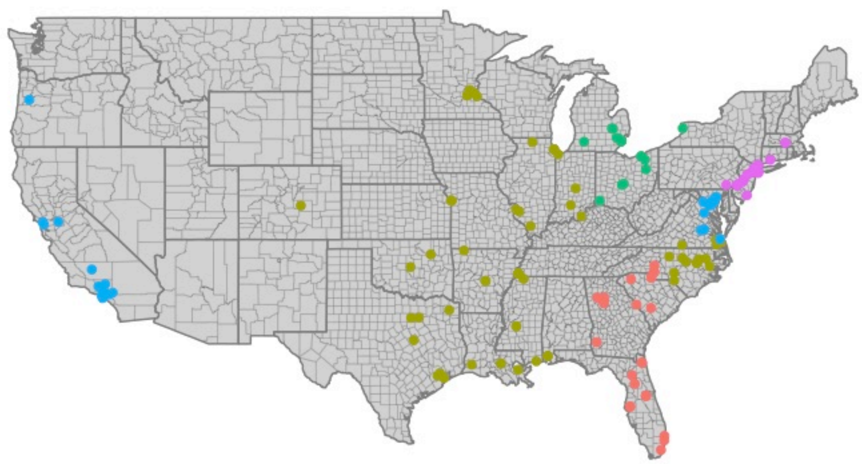


Figure 5.22: Result of agglomerative hierarchical clustering with 5 clusters

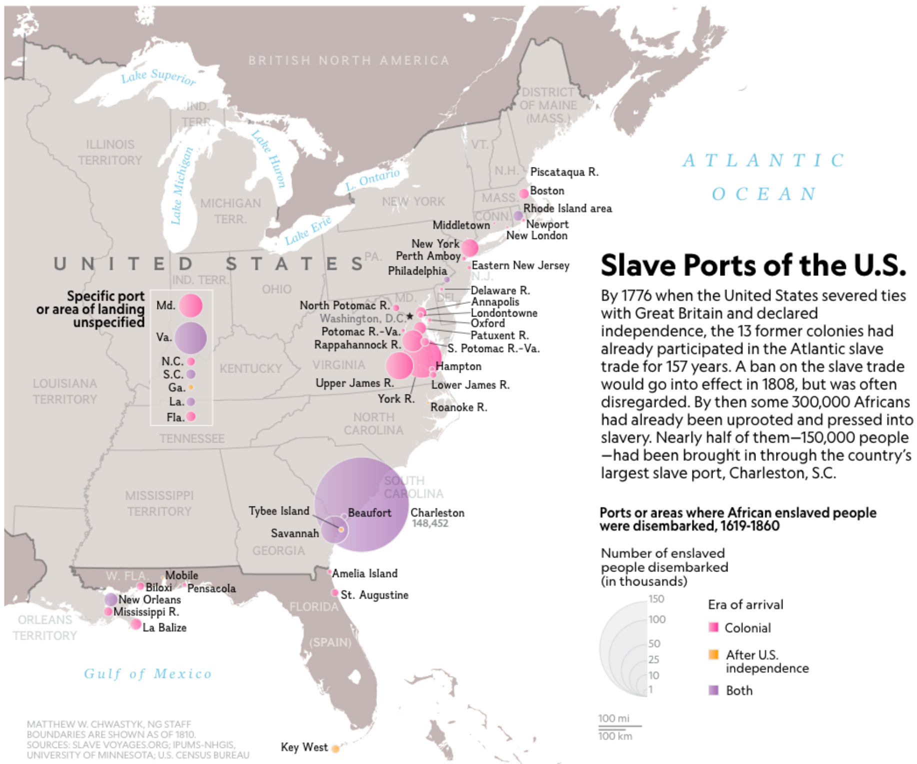


Figure 5.23: Map of Slave ports in the US, after Strochlich (????)

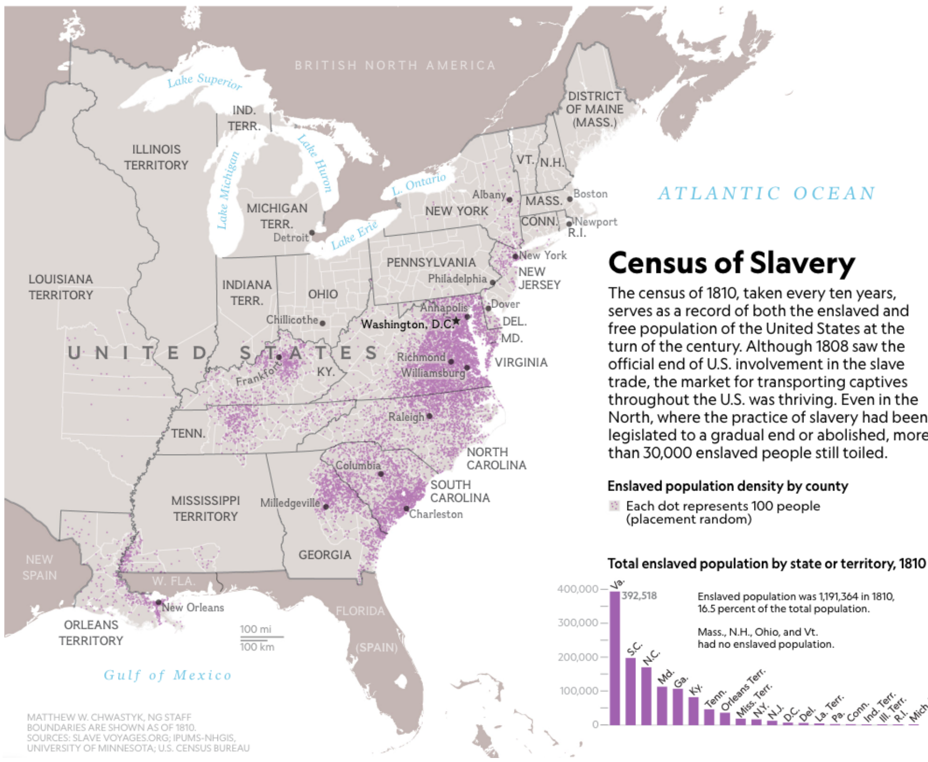


Figure 5.24: Map of the US enslaved population in 1810, following Strochlich (????)

geographic patterns that make intuitive sense in light of the Great Migration and massive segregation in Northern Cities. The fact that Chicago consistently patterns with Mississippi (as in figure 5.22) should come as no surprise, since much of the literature on the Great Migration is specifically about patterns of migration from Mississippi to Chicago, and by the end of the Great Migration, there were more African Americans in Chicago than all of Mississippi (Wilkerson, 2010, pp. 11). However, other geographic patterns are somewhat surprising, and may require more explanation. For instance, the consistent patterning of the Piedmont region of the Carolinas, especially North Carolina, with Chicago and Minneapolis (figure 5.20) and with the western Gulf States (figure 5.22).

Much of the literature on the Great Migration discusses broad patterns of movement – from the South to the North – without giving much attention to the exact patterns of travel. Similar to the situation with AAE accents, it is possible to find individual treatments of individual places, but there is not yet a systematic map of the patterns of movement. From the literature, however, we know that, for instance, people from parts of the Gulf and from the Southeast may have migrated north toward Washington D.C. as a gateway to the North (Wilkerson, 2010).[4] From Virginia, in particular, people went to Philadelphia. However, from Philadelphia, people followed the Pennsylvania Line, and may have gone as far west as Minneapolis (figure 5.25). Conversely, as is well described in the literature on the Great Migration, many from East Texas, Louisiana, and Mississippi, followed the Illinois Central Line up towards the Great Lakes (figure 5.26).

In light of these patterns of movement the relationship between the Piedmont region of the Carolinas and both the Gulf and Midwest makes more sense. Not only was the Piedmont region of the Carolinas a destination, but it could also have served as a starting point for migration, ending in the other destination region for the population moving *to* it.

[4] whence the derogatory term *bama*, ostensibly a truncation of 'Alabama,' meaning 'a rube,' in Washington D.C. AAE.

Figure 5.25: The Pennsylvania Line (image from www.American-rails.com)

What emerges unambiguously from these data, however, is that there is regional variation in AAE, it cannot be characterized by the AAVS alone, and it patterns with broad historical patterns of abduction, enslavement, and subsequent migration. In the next chapter, I will discuss the implications of these findings.

Figure 5.26: The Illinois Central Line (image from www.American-rails.com)

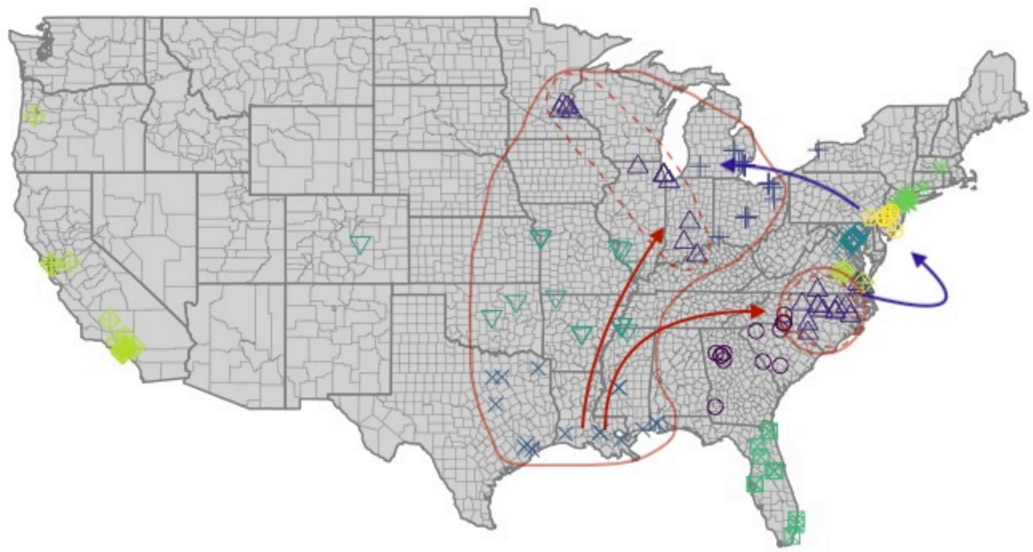


Figure 5.27: The Piedmont Triangle

Chapter 6

Conclusions

In this dissertation, I sought to describe previously undescribed patterns of regional variation in African American English, and to understand the reasons for that variation, following Trudgill's exhortation to the would-be dialect geographer to both describe and explain variation, cited in Chapter 2. Why was regional variation in AAE evidently not present in the late 1960s when the seminal studies were written? How does regional variation in AAE relate to the Great Migration? Why is it apparently largely unaffected by local white Englishes?

To do so, I made use of geostatistical methods not commonly used in linguistics, specifically to facilitate comparison with the gold standard in dialectology: the *Atlas of North American English*. I created a new reading passage to elicit naturalistic spoken AAE, of general use to sociolinguists studying AAE. I made use of new technologies, in the form of social media, to gather data – resulting in a 21st century twist on Labov et al's 20th century methods and Wenker's 19th century methods. I also developed a new method to investigate monophthongization, building on the work of Fought (1997), and combining her methods with those used in automatic speech recognition.

Several important findings came out of this study. I found:

1. There is considerable regional variation in African American English. There is no one black accent, but rather many. Following the clustering analysis performed in chapter 5, we can say with confidence that there are *at least* 10 distinct black American accents, and possibly upwards of 20.

2. I found further support for the existence of the African American Vowel Shift, but little support for its proposed universality. Rather, it is evidently regional in nature, and other regional accents (for instance, New York AAE and Philadelphia AAE) do not pattern with the AAVS at all.

3. The various accents in AAE are regional in nature (and not just related to other social

factors, such as gender or education).

4. The regional variation in AAE vocalic systems correspond to patterns of movement during the Great Migration.

5. AAE vocalic systems do not align with white regional variation. This is more than likely because of the massive residential, educational, and social segregation that followed the collapse of reconstruction and that persists after the fall of Jim Crow.

6. The regional patterns in AAE vocalic systems correspond to known lexical variation (cf Jones 2015b).

7. The geographic patterns of variation in AAE accents are suggestive of a founder effect predating the Great Migration, and possibly preceding the formation of African American English, going as far back as the beginnings of the slave trade, and suggesting possible regional variation in the Plantation Creole.

This dissertation has a number of limitations. First, the sample of AAE speakers was biased, both in ways that may be beneficial (the preponderance of female respondents) but also in ways that mask significant variation. For instance, the majority of respondents had attained a high level of formal education, which is known to correspond with a reduction in (marked) regional accents (Labov et al., 2016). This means that the true variation in AAE may be significantly underrepresented in these findings. Second, a larger sample could tell us much more about regional variation, however recruiting speakers was extremely time consuming, and the data pre-processing was difficult and time intensive. As such, this dissertation is only a first step, and points toward the need for a much larger study performed by a team over a longer period of time. Third, it should be borne in mind that the statistical methods used have some limitations. Kriging generates a value for all locations between sampled points, however this is not always meaningful. Even in places with no population, kriging interpolates expected values. This means that kriging estimates should be interpreted cautiously, and with an eye to what the results correspond to in the real world. Getis-Ord hot and cold values, similarly, draw out variation and hot-spots in the data, but they also normalize the data, meaning a 20Hz difference in one formant value may correspond to a 30Hz difference in another. Another point of caution is that clustering algorithms, like those employed in chapter 5, will find clusters no matter what – whether meaningful clusters are present in the data or not. However, the clusters found in chapter 5 are unlikely to have arisen by chance, as they pattern with known geographic and social phenomena, whereas clusters created from artificially generated data do not result in such clear cluster separation in two dimensions, let alone clusters that correspond to meaningful geo-social patterns. Fourth, this dissertation is limited to an examination of vowels in AAE, and has nothing to say about other patterns, including consonantal patterns, especially postvocalic consonants; prosody and suprasegmental features; and variation in lexical items and morphosyntax.

This dissertation suggests a number of avenues of further investigation and future research. Among them are investigations of regional variation in lexical and morphosyntactic items (e.g., use of *be done* constructions); investigations of the correlation between indices of segregation (e.g., dissimilarity index and isolation index, inter alia) and accommodation to local white norms; and investigations of regional variation in prosody. Some other research topics were also suggested by this work. Many speakers, especially female speakers, made use of dental and alveolar clicks, apparently as discourse markers – this phenomenon is known, but understudied, and warrants further research. There was also apparent variation in a number of linguistic variables that are understudied, or not described at all in the literature on AAE, including the realization of postvocalic nasals as nasalization on the vowel (or seemingly unspecified for manner, cf Jones 2015b) and deletion of postvocalic /v/ (resulting in [twɛw] *twelve* and [fɑː] *five*, for instance). There is room for further investigation of regional variation in the rate of deletion or vocalization of postvocalic liquids in these data.

There is further work to be done on regional variation in the trajectories of /ay/ in AAE, especially as related to raising. More should be done with other diphthongs, as there is little known about variation in /oy/ in AAE, although there is a stereotype of Atlanta AAE speakers pronouncing it differently than elsewhere. There is also broader research suggested by this disseration: what is the role of mobility and network density across geography in AAE, as speakers in, say, Chicago, return the Mississippi to visit family and vice versa? Was there regional variation in the Plantation Creole, and is it possible to begin to answer this question? Is a direct spatial comparison with the ANAE informative? Lastly, why doesn't the spatial description of the NCVS in chapter 3 correspond to what we might have expected – is it possibly the results of the combination of migration of people and a serial founder effect (Ramachandran et al., 2005) resulting in a geographic pattern opposite what a wave model might predict?

While there is much left to be done, this dissertation significantly advances our understanding of both variation in African American English and of spatial influences on language variation and change. I can offer some cautious conclusions from the above: First, there is not one black accent, but rather, there is massive regional variation in AAE. Second, regional variation in AAE is clearly related to the history of slavery and Jim Crow. That is, regional variation and language change is clearly constrained by social forces, including systemic racism. While systemic racism lurks in the background of discussions of colonialism resulting in new language varieties, especially in the New World, this dissertation provides evidence for its continued impact on the trajectory of development of a contemporary language variety. Lastly, while AAE is often treated as a monolithic ethnolect, it clearly exhibits regional variation in the vocalic system. This fact, taken in conjunction with the existing literature documenting regional variation in morphosyntax and lexical items suggests that AAE is perhaps best treated not as a single dialect (or ethnolect) but as a family of dialects in their own right.

Bibliography

Agha, Asif. 2003. The social life of cultural value. *Language & Communication* 23:231–273.

Agha, Asif. 2005. Voice, footing, enregisterment. *Journal of linguistic anthropology* 38–59.

Anderson, Bridget L. 2002. Dialect leveling and/ai/monophthongization among African American detroiters. *Journal of Sociolinguistics* 6:86–98.

Annon, Minnie Quartey. 2016. On the cusp of a breakthrough: Regional variation and linguistic diversity in education. Paper presented at New Ways of Analyzing Variation, 45.

Arnson, Shelby, and Charlie Farrington. 2017. Twentieth century sound change in washington dc African American English. *University of Pennsylvania Working Papers in Linguistics* 23:2.

Austen, Martha. 2017. put the groceries up comparing black and white regional variation. *American Speech: A Quarterly of Linguistic Usage* 92:298–320.

Bailey, Guy, and Natalie Maynor. 1989. The divergence controversy. *American Speech: A Quarterly of Linguistic Usage* 64:12–39.

Bailey, Guy, and Erik Thomas. 1998. Some aspects of African-American vernacular English phonology. In *African American English: Structure, history, and use*, ed. Salikoko

Mufwene, John R. Rickford, Guy Bailey, and John Baugh, 85–109. London and New York: Routledge.

Bailey, Trevor C, and Anthony C Gatrell. 1995. *Interactive spatial data analysis*, volume 413. Longman Scientific & Technical Essex.

Blake, Renée, and Cara Shousterman. 2010. Diachrony and AAE: St. louis, hip-hop, and sound change outside of the mainstream. *Journal of English Linguistics* 38:230–247.

Blake, Renee, Cara Shousterman, and Lindsay Kelley. 2009. Rethinking AAE research: The use of postvocalic /r/ by two groups of black new yorkers. *Selected Papers from New Ways of Analyzing Variation* 38:22–25.

Bloomfield, Leonard. 1933. *Language*. New York: Holt.

Brugman, Hennie, and Albert Russel. 2004. Annotating multi-media/multi-modal resources with elan. In *Proceedings of LREC*.

Carignan, Christopher, Ryan Shosted, Chilin Shih, and Panying Rong. 2011. Compensatory articulation in american English nasalized vowels. *Journal of Phonetics* 39:668–682.

Chambers, Jack K, and Peter Trudgill. 1998. *Dialectology*. Cambridge University Press.

Coggshall, Elizabeth L, and Kara Becker. 2009. The vowel phonologies of African American and white new york city residents. *Publication of the American Dialect Society* 94:101–128.

Collins, Chris, Simanique Mooday, and Paul Martin Postal. 2008. An AAE camouflage construction. *Language* 84:29–68.

Cutler, Cecilia A. 1999. Yorkville crossing: White teens, hip hop and African American English. *Journal of sociolinguistics* 3:428–442.

Dayton, Elizabeth. 1996. Grammatical categories of the verb in African-American Vernacular English. Doctoral Dissertation, University of Pennsylvania.

Denton, Nancy A. 1995. The persistence of segregation: Links between residential segregation and school segregation. *Minnesota Law Review* 80:795.

Dillard, Joey Lee. 1973. *Black English: Its history and usage in the united states*. Vintage Books New York.

Doyle, Gabriel. 2014. Mapping dialectal variation by querying social media. In *Proceedings of EACL*.

Eberhardt, Maeve. 2009. Identities and local speech in pittsburgh: A study of regional African American English. Doctoral Dissertation, University of Pittsburgh.

Edwards, Walter F. 2008. African American Vernacular English: phonology. *Varieties of English* 2:181–191.

Eisenstein, Jacob. 2013. Phonological factors in social media writing. *NAACL 2013* 11.

Equal Justice Initiative. 2017. Lynching in america: Confronting the legacy of racial terror .

Farrington, Charlie. 2018. Incomplete neutralization in African American English: The case of final consonant voicing. *Language Variation and Change* 30:361–383.

Farrington, Charlie, Jennifer Renn, and Mary Kohn. 2017. The relationship between segregation and participation in ethnolectal variants. *Acquiring Sociolinguistic Variation* 20:185.

Farrington, Charlie, and Natalie Schilling. 2019. Contextualizing the corpus of regional African American Language, DC: AAL in the nation's capital. *American Speech: A Quarterly of Linguistic Usage* 94:21–35.

Fasold, Ralph W. 1972. Tense marking in black English: A linguistic and social analysis. *Urban Language Series* 8.

Fasold, Ralph W, William Labov, Fay Boyd Vaughn-Cooke, Guy Bailey, Walt Wolfram, Arthur K Spears, and John Rickford. 1987. Are Black and White vernaculars diverging? papers from the NWAVE XIV panel discussion. *American Speech: A Quarterly of Linguistic Usage* 3–80.

Fasold, Ralph W, and Walt Wolfram. 1972. Some linguistic features of Negro dialect. *Language, Speech, and Hearing Services in Schools* 3:16–49.

Flach, Peter. 2012. *Machine learning: the art and science of algorithms that make sense of data*. Cambridge University Press.

Fought, Carmen. 1997. The English and spanish of young adult chicanos. Doctoral Dissertation, University of Pennsylvania.

Fridland, Valerie. 2003. 'Tie, tied and tight': The expansion of /ai/ monophthongization in African-American and european-american speech in Memphis, Tennessee. *Journal of Sociolinguistics* 7:279–298.

Getis, Arthur, and J Keith Ord. 2010. The analysis of spatial association by use of distance statistics. In *Perspectives on spatial data analysis*, 127–145. Springer.

Gold, Erica. 2009. The effects of video and voice recorders in cellular phones on vowel formants and fundamental frequency. Doctoral Dissertation, University of York.

Gordon, Matthew J. 2002. Investigating chain shifts and mergers. In *The handbook of language variation and change*, ed. J.K. Chambers and Natalie Schilling, volume 11, 244–266. Wiley Online Library.

Green, Lisa. 1998. Remote past and states in African-American English. *American Speech: A Quarterly of Linguistic Usage* 73:115–138.

Green, Lisa. 2004. African American English. *Language in the USA: Themes for the twenty-first century* 76–91.

Green, Lisa. 2014. Force, focus and negation in African American English. *Micro-Syntactic Variation in North American English* 115–142.

Green, Lisa J. 2002. *African American English: a linguistic introduction*. Cambridge University Press.

Green, Lisa J. 2010. *Language and the African American child*. Cambridge University Press.

Grieve, Jack. 2011. A regional analysis of contraction rate in written Standard American English. *International journal of corpus linguistics* 16:514–546.

Grieve, Jack. 2013. Ordinary kriging in dialectology. *QITL-5* 23.

Grieve, Jack. 2018. Spatial statistics for dialectology. *The handbook of dialectology* 415–33.

Grieve, Jack, Dirk Speelman, and Dirk Geeraerts. 2011. A statistical method for the identification and aggregation of regional linguistic variation. *Language Variation and Change* 23:193–221.

Hägerstrand, Torsten. 1952. *The propagation of innovation waves*. Royal Unversity of Lund, Department of Geography.

Hägerstrand, Torsten. 1965a. A monte carlo approach to diffusion. *Archives Européennes de Sociologie* 6:43–67.

Hägerstrand, Torsten. 1965b. Quantitative techniques for analysis of the spread of information and technology. *Education and economic development* 244–280.

Hägerstrand, Torsten. 1966. Aspects of the spatial structure of social communication and the diffusion of information. In *Papers of the Regional Science Association*, volume 16, 27–42. Springer.

Hägerstrand, Torsten. 1967a. *Innovation diffusion as a spatial process*. University of Chicago Press.

Hägerstrand, Torsten. 1967b. On monte carlo simulation of diffusion. *Quantitative geography, part* 1:1–32.

Harrison, Alferdteen. 1992. *Black exodus: The great migration from the American south*. University Press of Mississippi.

Hastie, Trevor, Robert Tibshirani, and Jerome Friedman. 2009. *The elements of statistical learning: data mining, inference, and prediction*. Springer Science & Business Media.

Hay, Jennifer, Paul Warren, and Katie Drager. 2006. Factors influencing speech perception in the context of a merger-in-progress. *Journal of phonetics* 34:458–484.

Herzog, Marvin I, William Labov, and Uriel Weinreich. 1968. Empirical foundations for a theory of language change. In *Directions for historical linguistics*, ed. Winfred P. Lehman and Yakov Malkiel. University of Texas Press.

Holliday, Nicole R. 2019. Variation in question intonation in the corpus of regional African American language. *American Speech: A Quarterly of Linguistic Usage* 94:110–130.

Houston, Susan H. 1969. A sociolinguistic consideration of the Black English of children in northern Florida. *Language* 599–607.

Ito, Rika. 1999. Diffusion of urban sound change in rural Michigan: A case of the northern cities shift. Dissertation, Michigan State University.

Ito, Rika, and Dennis R Preston. 1998. Identity, discourse, and language variation. *Journal of Language and Social Psychology* 17:465–483.

Jankowsky, Kurt R. 2019. *The neogrammarians: A re-evaluation of their place in the development of linguistic science*, volume 116. Walter de Gruyter.

Jones, Taylor. 2015a. *Eem* negation in aave: A next step in jespersen's cycle. Conference presentation.

Jones, Taylor. 2015b. Toward a description of African American Vernacular English dialect regions using black twitter. *American Speech: A Quarterly of Linguistic Usage* 90:403–440.

Jones, Taylor. 2016a. AAE talmbout: An overlooked verb of quotation. *University of Pennsylvania Working Papers in Linguistics* 22:11.

Jones, Taylor. 2016b. Tweets as graffiti: What the reconstruction of Vulgar Latin can tell us about black twitter. In *English in computer mediated communication: Variation, representation, and change*, ed. Lauren Squires. de Gruyter.

Jones, Taylor, Jessica Rose Kalbfeld, Ryan Hancock, and Robin Clark. 2019. Testifying while black: An experimental study of court reporter accuracy in transcription of African American English. *Language* 95:e216–e252.

Kendall, Tyler. 2018. The corpus of regional African American Language. version 2018.10. 06. Eugene, Oregon: Online resources for African American Language project.

King, Sharese. 2016. On negotiating racial and regional identities: Vocalic variation among African Americans in Bakersfield, California. *University of Pennsylvania Working Papers in Linguistics* 22:12.

King, Sharese. 2018. Exploring social and linguistic diversity across African Americans from Rochester, New York. Doctoral Dissertation, Stanford University.

Kohli, Sonali. 2014. Modern-day segregation in public schools. *The Atlantic* 18.

Kohn, Mary, and Charlie Farrington. 2013. A tale of two cities: Community density and African American English vowels. *University of Pennsylvania Working Papers in Linguistics* 19:12.

Kurath, Hans. 1949. A word geography of the eastern United States .

Labov, W. 1994. *Principles of Linguistic Change, volume 1: Internal Factors*. Wiley.

Labov, William. 1968. A Study of the Non-Standard English of Negro and Puerto Rican Speakers in New York City. Volume I: Phonological and Grammatical Analysis. .

Labov, William. 1972a. *Language in the inner city: Studies in the Black English vernacular*, volume 3. University of Pennsylvania Press.

Labov, William. 1972b. *Sociolinguistic patterns*. 4. University of Pennsylvania Press.

Labov, William. 1981. Resolving the neogrammarian controversy. *Language* 267–308.

Labov, William. 1991. The three dialects of English. In *New ways of analyzing sound change: Quantitative analysis of linguistic structure*, 1–44. Orlando, FLorida.

Labov, William. 1998. Co-existent systems in African-American vernacular English. *African-American English: Structure, History and Use* 110–153.

Labov, William. 2014. The role of African Americans in Philadelphia sound change. *Language Variation and Change* 26:1–19.

Labov, William, Sharon Ash, and Charles Boberg. 2005. *The atlas of North American English: Phonetics, phonology and sound change*. Walter de Gruyter.

Labov, William, and Sabriya Fisher. 2015. African American phonology in a Philadelphia community. *The Oxford Handbook of African American Language* 256.

Labov, William, Sabriya Fisher, Duna Gylfadottír, Anita Henderson, and Betsy Sneller. 2016. Competing systems in Philadelphia phonology. *Language Variation and Change* 28:273–305.

Lanehart, Sonja. 2015. *The Oxford handbook of African American Language*. Oxford University Press.

Lee, Sinae. 2016. In-group variation among African Americans in Washington DC: Neighborhood patterns of back vowel production. Paper presented at New Ways of Analyzing Variation, 45.

Legum, Stanley E, et al. 1971. The speech of young Black children in Los Angeles .

Lloyd, Stuart. 1982. Least squares quantization in PCM. *IEEE transactions on information theory* 28:129–137.

Malkiel, Yakov. 1964. *Each word has a history of its own*. Wenner-Gren Foundation for Anthropological Research.

Malkiel, Yakov. 1967. Every word has its own history. *Glossa* 1:1976.

Massey, Douglas S, and Nancy A Denton. 1988. The dimensions of residential segregation. *Social forces* 67:281–315.

Matheron, Georges. 1965. *Les variables régionalisées et leur estimation: une application de la théorie des fonctions aléatoires aux sciences de la nature*. Masson et CIE.

McDavid, Raven I, and Virginia Glenn McDavid. 1951. The relationship of the speech of American Negroes to the speech of whites. *American Speech: A Quarterly of Linguistic Usage* 26:3–17.

McLarty, Jason. 2018. African American Language and European American English intonation variation over time in the American South. *American Speech: A Quarterly of Linguistic Usage* 93:32–78.

McLarty, Jason, Taylor Jones, and Christopher Hall. 2019. Corpus-based sociophonetic approaches to postvocalic r-lessness in African American Language. *American Speech: A Quarterly of Linguistic Usage* 94:91–109.

Mitchell, Claudia I. 1969. *Language behavior in a Black urban community*. University of California, Berkeley.

Mitchell, David, Marivic Lesho, and Abby Walker. 2017. Folk perception of African American English regional variation. *Journal of Linguistic Geography* 5:1–16.

Montgomery, Michael, and Janet Fuller. 1996. What was verbal-s in 19th-century African American English. *Focus on the USA* 211–230.

Montgomery, Michael, Janet M Fuller, and Sharon DeMarse. 1993. the black men has wives and sweet harts [and third person plural-s] jest like the white men: Evidence for verbal-s from written documents on 19th-century African American speech. *Language Variation and Change* 5:335–357.

Mufwene, Salikoko S. 1996. The development of american Englishes: Some questions from a creole genesis perspective. *Focus on the USA* 231–264.

Mufwene, Salikoko S, et al. 2001. *The ecology of language evolution*. Cambridge University Press.

Nguyen, Jennifer G. 2006. *The changing social and linguistic orientation of the African American middle class*. University of Michigan.

Nycz, Jennifer, and Lauren Hall-Lew. 2013. Best practices in measuring vowel merger. In *Proceedings of Meetings on Acoustics 166ASA*, volume 20, 060008. Acoustical Society of America.

Osthoff, Hermann, and Karl Brugmann. 1880. *Morphologische untersuchungen auf dem gebiete der indogermanischen sprachen*, volume 3. S. Hirzel.

Paul, Hermann. 2010. *Prinzipien der sprachgeschichte [1880]*, volume 6. Walter de Gruyter.

Pew Research Center. 2019. Social media fact sheet. URL `https://www.pewresearch.org/internet/fact-sheet/social-media/`.

Pollock, Karen E, and Linette Hinton Meredith. 2001. Phonetic transcription of African American Vernacular English. *Communication Disorders Quarterly* 23:47–53.

Poplack, Shana. 2000. *The English history of African American English*. Blackwell Malden, MA.

Poplack, Shana, and Sali Tagliamonte. 2001. *African American English in the diaspora*. Blackwell Malden, MA.

Purnell, Thomas C. 2009. The vowel phonology of urban southeastern Wisconsin. *Publication of the American Dialect Society* 94:191–217.

R Core Team. 2017. *R: A language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna, Austria. URL `https://www.R-project.org/`.

Ramachandran, Sohini, Omkar Deshpande, Charles C Roseman, Noah A Rosenberg, Marcus W Feldman, and L Luca Cavalli-Sforza. 2005. Support from the relationship of genetic and geographic distance in human populations for a serial founder effect originating in africa. *Proceedings of the National Academy of Sciences* 102:15942–15947.

Rickford, J, and RJ Rickford. 2004. Suite for ebony and phonics: Reflections on African American English. *Tongue-tied: The lives of multilingual children in public education* 236–241.

Rickford, John, and Mackenzie Price. 2013. Girlz ii women: Age-grading, language change and stylistic variation. *Journal of Sociolinguistics* 17:143–179.

Rickford, John R. 1998. The creole origins of African-American Vernacular English: Evidence from copula absence. *African-American English: Structure, history and use* 154–200.

Rickford, John R. 2015. African American Vernacular English in california. *The Oxford Handbook of African American Language* 299.

Rickford, John R, Greg J Duncan, Lisa A Gennetian, Ray Yun Gou, Rebecca Greene, Lawrence F Katz, Ronald C Kessler, Jeffrey R Kling, Lisa Sanbonmatsu, Andres E Sanchez-Ordonez, et al. 2015. Neighborhood effects on use of African-American vernacular English. *Proceedings of the National Academy of Sciences* 112:11817–11822.

Rickford, John R, and Faye McNair-Knox. 1994. Addressee-and topic-influenced style shift: A quantitative sociolinguistic study. *Sociolinguistic perspectives on register* 235–276.

Rickford, John R, and Christine Theberge Rafal. 1996. Preterite had+ v-ed in the narratives of African-American preadolescents. *American Speech: A Quarterly of Linguistic Usage* 71:227–254.

Rickford, John R, and Russell John Rickford. 2000. *Spoken soul: The story of black English*. Wiley New York.

Riney, Timothy J. 1990. Linguistic controversies, vbe structures, and midwest attitudes. .

Rooney, Patrick, William Hussar, and Michael Planty. 2006. The condition of education 2006.

Rosenfelder, Ingrid, Josef Fruehwald, Keelan Evanini, Scott Seyfarth, Kyle Gorman, Hilary Prichard, and Jiahong Yuan. 2014. ”fave (forced alignment and vowel extraction) suite version 1.1.3”.

Rousseeuw, Peter J. 1987. Silhouettes: a graphical aid to the interpretation and validation of cluster analysis. *Journal of computational and applied mathematics* 20:53–65.

Scanlon, Michael, and Alicia Beckford Wassink. 2010. African American English in urban seattle: Accommodation and intraspeaker variation in the pacific northwest. *American Speech: A Quarterly of Linguistic Usage* 85:205–224.

Schilling-Estes, Natalie. 1995. Extending our understanding of the/z/[d] rule. *American Speech: A Quarterly of Linguistic Usage* 291–302.

Schneider, Edgar W. 2008. *The americas and the caribbean*, volume 2. Walter de Gruyter.

Smallwood, Arwin D, and Jeffrey M Elliot. 1998. *The atlas of African-American history and politics: From the slave trade to modern times*. McGraw-Hill Humanities/Social Sciences/Languages.

Smitherman, Geneva. 1998. Word from the hood: The lexicon of African-American vernacular English. *African American English: Structure, history, and use* 203–225.

Sneller, Betsy. 2014. Antagonistic contact and inverse affiliation: Appropriation of/th/-fronting by White speakers in South Philadelphia. *University of Pennsylvania Working Papers in Linguistics* 20:19.

Sneller, Betsy. 2019. Phonological rule spreading across hostile lines:(th)-fronting in Philadelphia. *Language Variation and Change* 1–23.

Spears, Arthur K. 1982. The Black English semi-auxiliary come. *Language* 850–872.

Spears, Arthur K. 2009. On shallow grammar: African American English and the critique of exceptionalism. *The Languages of Africa and the Diaspora: Educating for Language Awareness* 12:231.

Spears, Arthur K, et al. 1998. African-American language use: Ideology and so-called obscenity. *African-American English: Structure, history, and use* 226–250.

Spears, Arthur K, et al. 2015. African American standard English. *The Oxford Handbook of African American Language* 786–799.

Stancil, Will. 2018. School segregation is not a myth. *The Atlantic* .

Steinhaus, Hugo. 1956. Sur la division des corp materiels en parties. *Bull. Acad. Polon. Sci* 1:801.

Stewart, William A. 1967. *Sociolinguistic factors in the history of american negro dialects*. Peter Lang Publishing, Inc. New York, NY.

Strochlich, Nina. ???? How slavery flourished in the united states. URL `https://www.nationalgeographic.com/culture/2019/08/how-slavery-flourished-united-states-chart-maps/`.

Thomas, Erik. 2002. Instrumental phonetics. In *The handbook of language variation and change*, chapter 7, 168–200. Oxford, UK: Blackwell.

Thomas, Erik R. 2001. An acoustic analysis of vowel variation in new world English. *Publication of the American Dialect Society* .

Thomas, Erik R. 2006. Evidence from ohio on the evolution of/æ. *Language variation and change in the American Midland: A new look at Heartland English* 69–89.

Thomas, Erik R. 2007. Phonological and phonetic characteristics of African American vernacular English. *Language and Linguistics Compass* 1:450–475.

Thomas, Erik R. 2015. Prosodic features of African American English. *The Oxford handbook of African American language* 420–435.

Thomas, Erik R, and Guy Bailey. 2015. Segmental phonology of African American English. *The Oxford Handbook of African American Language* 403.

Thomas, Erik R, Alicia Beckford Wassink, C Llammas, and D Watt. 2010. Variation and identity in African-American English. *Language and identities* 157.

Thorndike, Robert L. 1953. Who belongs in the family? *Psychometrika* .

Tibshirani, Robert, Guenther Walther, and Trevor Hastie. 2001. Estimating the number of clusters in a data set via the gap statistic. *Journal of the Royal Statistical Society: Series B (Statistical Methodology)* 63:411–423.

Tolnay, Stewart E. 2003. The African American great migration and beyond. *Annual Review of Sociology* 29:209–232.

Troike, Rudolph C. 2015. Creole /l/→ /r/ in African American English/Gullah: Historical fact and fiction. *American Speech: A Quarterly of Linguistic Usage* 90:6–83.

Trudgill, Peter, Stephen Trudgill, et al. 1974. *The social differentiation of English in norwich*, volume 13. CUP Archive.

Van Herk, Gerard. 2008. Fear of a black phonology: The northern cities shift as linguistic white flight. *University of Pennsylvania Working Papers in Linguistics* 14:19.

Van Herk, Gerard. 2012. *What is sociolinguistics?*, volume 6. John Wiley & Sons.

Veatch, Thomas Clark. 1991. English vowels: Their surface phonology and phonetic implementation in vernacular dialects .

Walker, James A. 2005. The ain't constraint: Not-contraction in early African American English. *Language Variation and Change* 17:1–17.

Weinreich, Max. 1945. Der YIVO un di problemen fun undzer tsayt. *YIVO bleter* 25:3–18.

Wenker, Georg. 1881. *Sprach-atlas von nord-und mitteldeutschland: Text und einleitung: auf grund von systematisch mit hülfe der volksschullehrer gesammeltem material aus circa 30000 orten*. Trübner.

Wilkerson, I. 2010. *The Warmth of Other Suns: The Epic Story of America's Great Migration*. Knopf Doubleday Publishing Group. URL `https://books.google.com/books?id=Y03WKII5m7QC`.

Wilkerson, Isabel. 2011. *The warmth of other suns: The epic story of America's great migration*. Vintage.

Wolfram, Walt. 1974. The relationship of White Southern speech to Vernacular Black English. *Language* 498–527.

Wolfram, Walt. 1989. Structural variability in phonological development: Final nasals in Vernacular Black English. *Language change and variation* 301–332.

Wolfram, Walt. 1994. On the sociolinguistic significance of obscure dialect structures: The [NPi call NPi V-ing] construction in African-American Vernacular English. *American Speech: A Quarterly of Linguistic Usage* 339–360.

Wolfram, Walt. 2003. Reexamining the development of African American English: Evidence from isolated communities. *Language* 282–316.

Wolfram, Walt. 2007. Sociolinguistic folklore in the study of African American English. *Language and Linguistics Compass* 1:292–313.

Wolfram, Walt, and Mary Kohn. 2015. Regionality in the development of African American English. *The Oxford Handbook of African American Language* 140.

Wolfram, Walt, and Erik Thomas. 2008. *The development of African American English*. John Wiley & Sons.

Wolfram, Walter A. 1969. A sociolinguistic description of Detroit Negro speech. urban language series 5.

Wrede, Ferdinand, Georg Wenker, Bernhard Christian Friedrich Martin, and Walther Mitzka. 1927. *Deutscher sprachatlas*. Elwert.

Wroblewski, Michael, Thea Strand, and Sylvie Dubois. 2009. Mapping a dialect mixtury: Vowel phonology of African American and White men in rural southern Louisiana. *Publication of the American Dialect Society* 94:48–72.

Yaeger-Dror, Malcah, and Erik R Thomas. 2010. *African American English speakers and their participation in local sound changes: A comparative study*. Duke University Press for the American Dialect Society.

Zelinsky, Wilbur. 1973. *The cultural geography of the United States*. Prentice-Hall.