Abstract

GRIMES, ANDREW GELVIN BURLEY. In search of ethnic cues: the status of /æ/ and /ɛ/ and their implications for linguistic profiling. (Under the direction of Erik R. Thomas).

Historically, the study of African American English (AAE), perhaps the most thoroughly documented language variety in the United States, has been centered on syntactic and morphological characteristics. The phonological features that have been discussed are generally limited to consonantal characteristics such as consonant cluster reduction; thorough studies of the vowel systems of African American speakers have only begun to appear in earnest in the literature since the 1990s. Similarly, systematic studies of dialect perception, despite a long tradition in experimental phonetics, have only sporadically been employed in sociolinguistics. This thesis begins to fill both of these gaps by (1) reporting results from two ethnic identification experiments conducted in North Carolina and by (2) reporting data collected from a comparative analysis of two vowels as produced by NC black and white speakers. The vowels examined were /æ/ and /ɛ/, which are both reported to be raised by African American speakers.

The perception experiments required a process of instrumental resynthesis of recorded speech to generate stimuli approximating a continuum of values between two dialectal vowel variants. This process, used for both /æ/ and /ɛ/, is based on the source-filter theory of vowel production and entails the use of the phonetics software Praat. Using LPC analysis, Praat can synthetically extract a "filter" from a recorded vowel sound, thereby leaving an approximation of the speaker's unfiltered glottal source. This

"filter" can then be manipulated to represent different formant values and used to refilter the previously generated source signal. With this procedure, a range of experimental stimuli were created for /æ/ and /ɛ/, representing a continuum of vowels between the black and white variants for each. Results from experimental subjects who heard the stimuli demonstrate that for both /æ/ and /ɛ/, there was a significant correlation between vowel height and ethnic identification: the stimuli representing a higher vowel position were perceived more often to have been produced by an African American speaker than the stimuli representing a lower vowel position. Furthermore, this correlation seems to be stronger for /æ/ than for /ɛ/. The data generated by the production study corroborate these perception results. In the production study, F_1 measurements were taken from African American (AA) and European American (EA) pronunciations of the vowels /æ/ and /ɛ/. These measurements came from field recordings of North Carolina speakers from the North Carolina Language and Life Project archives. The results from this study show a statistically significant difference in the mean AA height and the mean EA height for both of these vowels; furthermore, the difference between the two means for /æ/ was much greater than the difference for /ɛ/.

The impetus for this ethnic identification approach to the analysis of dialect perception comes from the reality of linguistic profiling. Potential landlords and other real estate professionals use this type of racial discrimination to deny housing opportunities to minorities inquiring over the telephone about property availability. The use of such practices is a documented reality; however, many people reject the notion that

speakers' ethnicities can be identified based only on their voices. It is hoped that the empirically generated perception data presented here will provide incontestable evidence for the *plausibility* of linguistically based discrimination practices, and thereby help to solidify the case for legal defendants who have experienced this type of discrimination.

IN SEARCH OF ETHNIC CUES: THE STATUS OF /æ/ AND /ɛ/ AND THEIR IMPLICATIONS FOR LINGUISTIC PROFILING

by
Drew Grimes

A thesis submitted to the Graduate Faculty of
North Carolina State University
in partial fulfillment of the
requirements for the Degree of
Master of Arts

ENGLISH

Raleigh

2005

APPROVED BY:

_____ _____

_____
Chair of Advisory Committee

Biography

In 1979, Andrew Gelvin Burley Grimes was third-born a month late to Marty and Larry Grimes in Anderson, SC. After spending his childhood in the boy's 80s world of Transformers, G. I. Joes, and Superfriends, Drew stumbled into the 90s together with the Internet as the last vestiges of the Cold War receded into obsoleteness. In 1998, after living in the French town of Dijon for one year and visiting many other parts of Europe, Drew embarked on his voyage of higher education at Middle Tennessee State University. He there decided to sate his internationally nurtured proclivity towards language and culture by pursuing a double major in Anthropology and French. In the process, Drew not only became more and more enamored with his soon-to-be wife, Kelly, but also became aware of the field of sociolinguistics. This eventually manifested itself through his work in the form of an honors thesis on the perception of certain features of Southern American English. After marriage in August 2002 and graduation in December 2002, Drew found employment as a construction worker in suburban Nashville. Later, as an NCLLP staff member and graduate student at NCSU, Drew found not only an intellectual and academic home in his work in experimental sociophonetics, but also a community-oriented creative outlet in ongoing video production projects concerning people and places in North Carolina. Drew has also found part-time employment as an instructor of ESL at the continuing education program at NCSU. Immediately after graduation, Drew will continue to collaborate with Ryan Rowe on a video production about the rich history of Princeville, North Carolina.

Acknowledgments

Table 0-1 Table of recognition for people without whose patience/help/support/love/ encouragement/advice this thesis (let alone my M.A.) would not have been realized

Kelly Grimes	My lovely and supportive wife of three years (here's to a million more)
Erik Thomas	My esteemed and revered committee chair (and an intelligent source for anything sociophoneticky)
Walt Wolfram	Possibly the most helpful, generous, and encouraging man in the world
Agnes Bolonyai	For good and thorough feedback and a good experience as a 210 TA
Larry Grimes	Not only a great dad, but also a great statistical consultant, without whose patient explanations I would have been sunk
Elliott Moreton	For thorough, enthusiastic, and inspirational instruction in the specifics of linguistic phonetics
Ryan Rowe	For insightful and informative discussions on the way to Princeville and back
Tyler Kendall	For love and catsitting, Praat-scripting, spreadsheeting and music-listening advice
Jeannine Carpenter	For help with initial brainstorming on the continuum approach, as well as general mirth and merry-making
Libby Coggshall	For much-appreciated company to Chapel Hill and back
Melissa Damann	For much-appreciated late night cookies
Team Chainsaw	Elsewise Chapter 5 would not have been!
My MTSU profs	For a superb and supportive introduction to the world of linguistics
Chris Wiesen	Of the UNC Odom institute, for statistical consultation
Neal Hutcheson	For sharing a workspace, and for enlightening instruction in the world of Final Cut Pro, After Effects, Photoshop, the XL-1, and on and on
"The entire NCLLP family"	For love and an incredible working environment. I've never been a part of a more enthusiastic, hardworking and friendly group of people.
My entire biological family	Cheers to Mom & Dad, Steve & Donna, Meg & Matt, Wade & Jen, Hannah, Benjamin, Nathan, Timothy, Elizabeth, Sarah & Molly

Table of Contents

LIST OF FIGURES ..... **VI**

LIST OF TABLES ..... **VII**

CHAPTER 1 – INTRODUCTION AND RATIONALE **1**

OVERVIEW 1
SOCIAL APPLICATION 3
Race, biology, and ethnicity *3*
Racial and linguistic profiling *5*
SOCIOLINGUISTIC APPLICATION 13

CHAPTER 2 – LITERATURE: THE NEXUS OF SEVERAL TRADITIONS OF RESEARCH IN SOCIOLINGUISTICS **15**

VOWELS IN AFRICAN AMERICAN ENGLISH 15
PERCEPTION IN SOCIOLINGUISTICS 19
LINGUISTIC PROFILING 20

CHAPTER 3 – A TEST TO EXAMINE THE SALIENCE OF /æ/ **23**

METHODOLOGY 23
Creation and selection of stimuli *23*
Experiment structure for Part 1 ..... *25*
Experiment structure for Part 2 ..... *28*
RESULTS & DISCUSSION 34
Part I *34*
Part 2 ..... *36*
Discussion *39*
CONCLUSION 42

CHAPTER 4 – A TEST TO EXAMINE THE SALIENCE OF /ɛ/ **43**

METHODOLOGY 43
Creation and selection of stimuli *43*
Experiment structure *46*
RESULTS AND DISCUSSION 47

CHAPTER 5 – ADVENTURES IN INSTRUMENTAL ANALYSIS: /æ/ AND /ɛ/ AS PRODUCED BY NORTH CAROLINA BLACK AND WHITE SPEAKERS **52**

INTRO 52
METHODOLOGY 52
Speakers *52*
Procedure *54*
RESULTS 56
DISCUSSION 60
Findings *60*
Limitations *61*

CHAPTER 6 – CONCLUSIONS **63**

OTHER CONSIDERATIONS 66

REFERENCE LIST **69**

APPENDIX A. RESPONSE SHEET FOR CHAPTER 3 EXPERIMENT 74
APPENDIX B. RESPONSE SHEET FOR CHAPTER 4 EXPERIMENT..... 78
APPENDIX C. PRAAT SCRIPT FOR SEGMENTING LONG RECORDINGS 81
APPENDIX D. PRAAT SCRIPT FOR RECORDING FORMANT DATA 82

List of Figures

FIGURE 1-1 PERCENT PER BLOCK GROUP OF PERSONS WHO ARE WHITE ALONE, NOT HISPANIC OR LATINO. RALEIGH, NC. MAP GENERATED BY AMERICAN FACTFINDER 7
FIGURE 1-2 PERCENT PER BLOCK GROUP OF PERSONS WHO ARE BLACK OR AFRICAN AMERICAN ALONE, RALEIGH, NC. MAP GENERATED BY AMERICAN FACTFINDER 8
FIGURE 1-3 FRAME FROM AN AD COUNCIL COMMERCIAL 12
FIGURE 1-4 FAIR HOUSING AD CREATED BY THE NATIONAL FAIR HOUSING ALLIANCE 13
FIGURE 3-1 MEAN /æ/ FORMANT VALUES FOR EACH ETHNICITY 24
FIGURE 3-2 EQUATION USED TO CONVERT FORMANT VALUES TO THE BARK SCALE (TRAUNMÜLLER 1990) . 25
FIGURE 3-3 DIFFERENCE IN BARK VALUES FOR EACH STIMULUS IN PART 1 27
FIGURE 3-4 SPECTRAL SLICE FROM A NARROW-BAND SPECTROGRAM OF /æ/ (PRODUCED BY ME) 30
FIGURE 3-5 SPECTRAL SLICE OF A NARROW-BAND SPECTROGRAM FROM THE /æ/ *SOURCE* SOUND, AS APPROXIMATED BY PRAAT FROM THE VOWEL SOUND IN FIGURE 3-4 31
FIGURE 3-6 TRENDLINE BETWEEN PETERSON AND BARNEY (1952) VALUES FOR /æ/ AND /ɛ/ 32
FIGURE 3-7 DEFINING VARIABLES 35
FIGURE 3-8 BAR GRAPH OF PART 2 STIMULI PERCEIVED AS AA 38
FIGURE 3-9 COMPARISON OF THE MEAN FORMANT VALUES FROM PETERSON AND BARNEY (1952) FOR /æ/ AND /ɛ/ AND MY CURSORY MEASUREMENTS OF AA /æ/ AND EA /æ/ 41
FIGURE 4-1 TRENDLINE CALCULATED FROM THE MEDIAN MEASURED VALUES FROM AFRICAN AMERICAN AND EUROPEAN AMERICAN PRONUNCIATIONS OF /ɛ/ 44
FIGURE 4-2 BAR GRAPH OF /ɛ/ STIMULI PERCEIVED AS AA 47
FIGURE 5-1 NULL AND ALTERNATIVE HYPOTHESES 56
FIGURE 5-2 BOXPLOTS FOR THE /æ/ AND /ɛ/ RESULTS FOR EACH ETHNICITY 58
FIGURE 5-3 95% CONFIDENCE INTERVALS FOR EACH ETHNICITY'S MEAN VALUE IN EACH VOWEL CLASS 59

List of Tables

TABLE 1-1 INDIVIDUAL INSTANCES OF HOUSING DISCRIMINATION FOR 2003. FROM THE NATIONAL FAIR HOUSING ALLIANCE 10
TABLE 3-1 TARGET F_2 VALUES FOR /æ/ CALCULATED USING THE TREND LINE 33
TABLE 3-2 χ^2 CONTINGENCY TABLES, BROKEN DOWN BY VARIOUS PARAMETERS 36
TABLE 3-3 χ^2 TABLE OF PERCENTAGES FOR PART 2 37
TABLE 3-4 LSMEANS FOR PERCEIVED ETHNICITY FOR EACH CONTINUUM POINT 38
TABLE 3-5 TABLE OF P-VALUES FOR PAIRWISE COMPARISON OF THE CONTINUUM POINT PROPORTIONS 40
TABLE 4-1 F_2 VALUES FOR /ɛ/ CALCULATED USING THE TREND LINE 45
TABLE 4-2 SPEAKER ETHNICITY AND REPRESENTATIVE WORD FOR EACH /ɛ/ CONTINUUM POINT 46
TABLE 4-3 TABLE OF ANOVA-GENERATED P-VALUES FOR EFFECT ON LISTENER RESPONSE 48
TABLE 4-4 TABLE OF P-VALUES FOR PAIRWISE COMPARISON OF THE CONTINUUM POINT PROPORTIONS 49
TABLE 5-1 SPEAKERS 53
TABLE 5-2 CALCULATED χ^2 VALUES FOR THE CONTRASTS BETWEEN ETHNICITIES FOR EACH VOWEL, ALONG WITH THE CORRESPONDING P-VALUES 57
TABLE 5-3 MEAN F_1 VALUES FOR EACH ETHNICITY AND VOWEL 59

Chapter 1 – Introduction and rationale

Overview

This thesis consists of a sociolinguistic investigation into the phenomenon of ethnic identification, and its implications for linguistic profiling. I report the results of a series of three experiments designed to examine the significance of the front lax vowels /æ/ and /ɛ/ in African American English (AAE) and the degree to which they are diagnostic for ethnicity. Using experimental methodology, I will show that listeners need only a minimal amount of linguistic information to make a decision regarding the ethnicity of a speaker, and that the front lax vowels play an important part in this process.

The thesis is organized as follows. The remainder of Chapter 1 consists of a discussion of the social and sociolinguistic applications for the results of these experiments. Chapter 2 contains a review of the relevant literature on AAE vowels, perception in sociolinguistics, and linguistic profiling. Chapter 3 describes and reports the results from an experiment testing the perception of the quality of the vowel /æ/. Chapter 4 reports comparable results from a similar experiment designed to test for /ɛ/, with a methodology slightly revised in response to certain results from the experiment from Chapter 3. Chapter 5 reports on a traditional vowel production study of the vowels

/æ/ and /ɛ/, generating comparable data from North Carolina black speakers and white speakers[1]. The last chapter contains general conclusions and discussion.

The results reported in this thesis provide evidence of a systematic difference between the vowel system used by African American speakers and the three major vowel systems identified by Labov (1991). It will be clear from the Chapter 5 results that, for the vowels /æ/ and /ɛ/, there is a substantial and statistically significant difference in vowel height between the two speaker groups. Furthermore, the difference for /æ/ is much *more* significant than the difference for /ɛ/. These findings line up well with the findings from the two perception experiments. For both of these vowels, perception results identified a correlation between vowel height and the listeners' impression of speaker ethnicity. Moreover, the correlation for /æ/ was much stronger than the correlation for /ɛ/. In the same way that the difference between vowel height means for /æ/ was much more significant than the difference for /ɛ/, the correlation between vowel height and listener response was much stronger for /æ/ than for /ɛ/. Therefore, not only do we have *production* evidence of a divergence between African American and European American speakers in North Carolina for these vowels, this evidence is supported by *perception* evidence that shows that listeners are aware of these features and associate them with ethnicity.

[1] Support for the research projects presented in Chapter 3, Chapter 4 & Chapter 5 came from NSF grant BCS-0213941.

Social Application

There are many extant studies that demonstrate on a global level that listeners are able to differentiate between speakers of different ethnicities using only the sound of their voice. The results reported here add to ongoing research on the *specific* characteristics of AAE and white varieties that enable listeners to distinguish between these dialects' speakers. The results also provide evidence that such distinctions can be made even with a minimal amount of linguistic information. It will be argued that listeners are attuned to these vowel features, specifically the height of /æ/, and that it doesn't take much to make an assumption about the speaker. These findings are important because of their implications for linguistic profiling.

Race, biology, and ethnicity

One of the most widespread misconceptions found among Americans concerns the idea of race[2]. The popular understanding of race is that racial categories are concrete, self-evident and biologically endowed. The traditional *races* are thought of not as arbitrary divisions constructed *by* humans, but rather as *biological* categories, as the sub-specific representation of an even more detailed system for biological classification – much like the system for organizing breeds of horses and pets. It should be made clear, however, that this is in fact not an appropriate comparison. To maintain that human races

[2] As a result of growing overt attempts to not come across as racist, many scholars recently have taken to using the word *ethnicity* as a sort of euphemism for *race*. In this thesis I will do the same. However, it should be pointed out that in the view of Omi and Winant (1994), for example, it is a mistake to think of race as the same as ethnicity. They hold that the ethnicity paradigm follows a model of assimilation based on European immigration patterns, in which ethnic groups from Europe moved to and settled together in the New World, and were subsequently gradually assimilated into the majority. Because of the forced and exploitative nature of African immigration to the New World, the African experience in America has been much much different.

are like different breeds of animals implies that maintaining racial purity is necessary and indeed desirable, if for no other reason than for the sake of organization. And it is clear that an ideology centered on the maintenance of racial purity is ethically problematic. Indeed, in *overt* discourse, such an ideology, as is propagated by organizations such as the Ku Klux Klan and Bob Jones University, has either forced those organizations to the fringe of society (in the first case), or simply caused them to reform (in the second case) (see CNN 2000).

Even though the *overt,* accepted attitude is to reject the ideology of racial purity, many Americans continue to maintain an *essentialist* view of race; that is to say, they believe that each idealized racial category is made up of a group of people who all display a certain characteristic or set of characteristics, to the exclusion of all others who do not display such characteristics. This is something that will henceforth be referred to as the belief in *the biological essentialism of race.* The reality, on the contrary, is that whether people have one or two stars on their belly, to borrow an allegory from Dr. Seuss, depends *not* on biology, but rather on what is dictated by society (Seuss 1961). Humans as a worldwide species display nearly infinite morphological variation that is only *minimally* mitigated by biological similarities. The most compelling support for this comes from a 1972 article by R.C. Lewontin. Here, Lewontin presents results from an analysis of global human genetic characteristics, counting traditional differentiating features such as the amount of pigment contained in skin as only one of many possible variations. Interestingly, the results from this study demonstrate that the vast majority of human genetic variation is present *within* the traditionally defined races. In Lewontin's

words (and with his exclamation point), “Less than 15% of all human genetic diversity is accounted for by differences between human groups!” (22). Gates (1997) is a collection of many studies providing evidence for this, gleaned from both the natural and social sciences.

All of that said, according to Omi and Winant (1994), “the transcendence of biologistic conceptions of race does not provide any reprieve from the dilemmas of racial injustice and conflict, nor from controversies over the significance of race in the present” (65). To simply acknowledge that “race is a social construct” does not solve any problems: even though the categories are indeed socially identified, people *still act on these categories,* passing vast, overgeneralizing judgments about people and assuming that all of the members of a group have certain physical and, yes, social and psychological characteristics.

Racial and linguistic profiling

Despite the realities discussed above, which are well documented in the literature, the belief in the biological essentialism of race persists in the minds of the American public. This reality speaks to the power, often disregarded in preference to that of biology, that *society* wields in determining who we are and the perspective that we have on the world. Therefore, racial categories that have been historically delimited by social conventions, however arbitrary and inaccurate the phenotypes are that these separations are based upon, and however self-serving the intentions were of the powerful classes that fixed these conventions, are nevertheless significant, longstanding and influential. Race is a reified reality; it exists, not because of biology, but because of society.

According to Wikipedia, *Racial profiling* refers to "the use of race as a consideration in suspect profiling or other law enforcement practices" (Racial Profiling 2005). This law enforcement tactic is highly controversial, and has led to the unnecessary and unfair traffic stops of African American drivers along many of America's highways – the phrase "driving while black" is often used to refer to this type of targeting. This is one way that people can and do make decisions that affect the lives of others based on what they look like. But the socially determined characteristics that are used to sort people into racial categories include more than just visible attributes. A second type of profiling that often occurs is that of *linguistic profiling*; this is a type of profiling, occurring in situations where a speaker can be heard and not seen, where the speaker is quickly labeled as a minority and judged, categorized, and discriminated against. This most often occurs over the telephone, and therefore is one of the most prevalent manifestations of housing discrimination. As a result, because it happens in the privacy of homes and businesses, it is perhaps much more subtle and undetectable than other types of discrimination. But its effects are just as detrimental, and they aid in the persistence of segregation norms. This persistence of racial segregation trends and the unequal demographic realities of American neighborhoods, despite legislation designed to reduce such realities, reveals a corresponding persistence of a deep-seeded, structural, social tendency towards inequality. Figure 1-1 and Figure 1-2 are cartographic illustrations of the reality of de facto housing segregation. The website of the U.S. Census Bureau provides the capability to generate thematic maps using data from the 2000 census (http://factfinder.census.gov). In this case, each geographical block group is

situated on a range of colors, according to the percentage of that block group's population that is made up of people of a given race. Figure 1-1 maps the percentages of Raleigh's white residents – the darker the shade of green, the higher the percentage of white residents in that block group. Figure 1-2, on the other hand, maps in the same fashion the percentages of black residents – we can see that the two maps present us with a near exact inverse relationship.

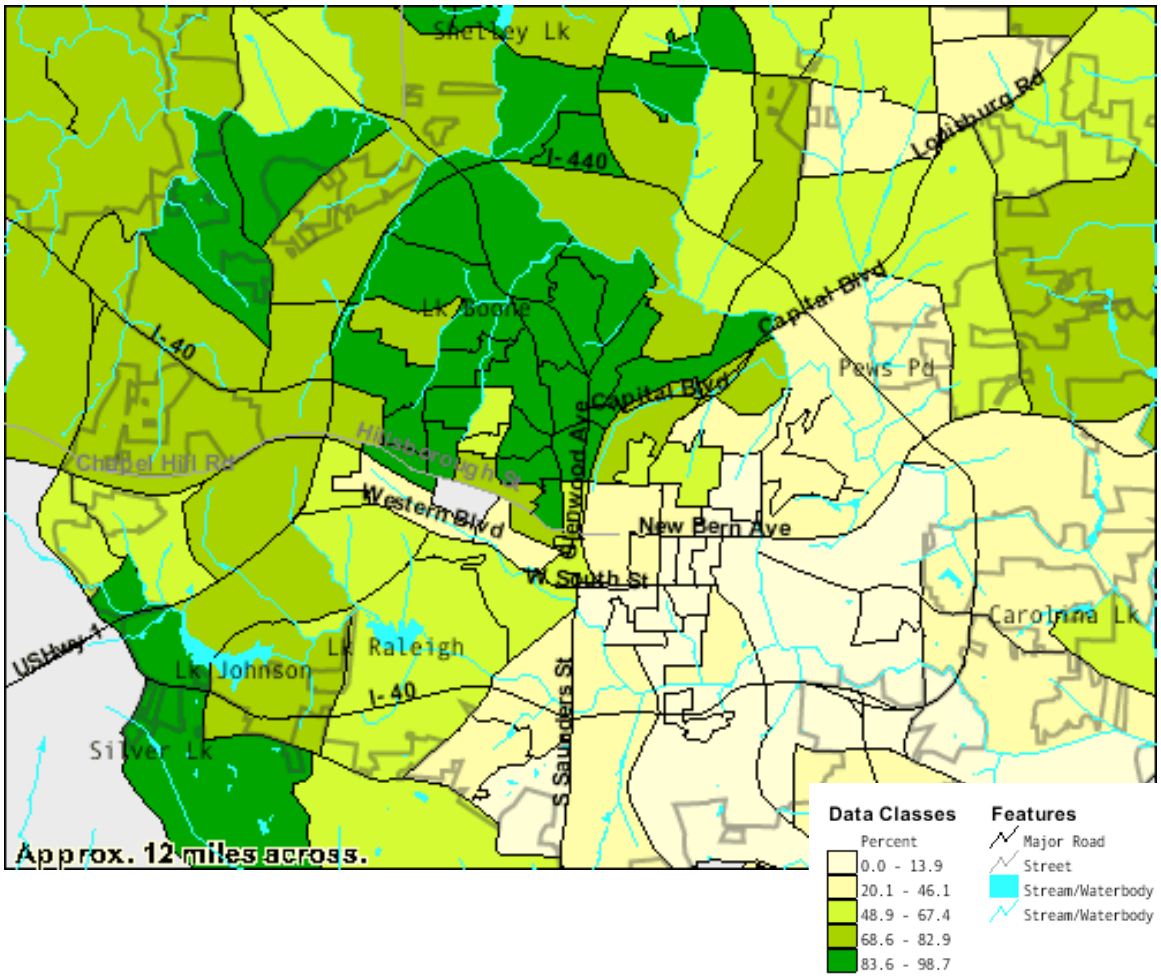


Figure 1-1 Percent per block group of persons who are white alone, not Hispanic or Latino. Raleigh, NC. Map generated by American FactFinder.

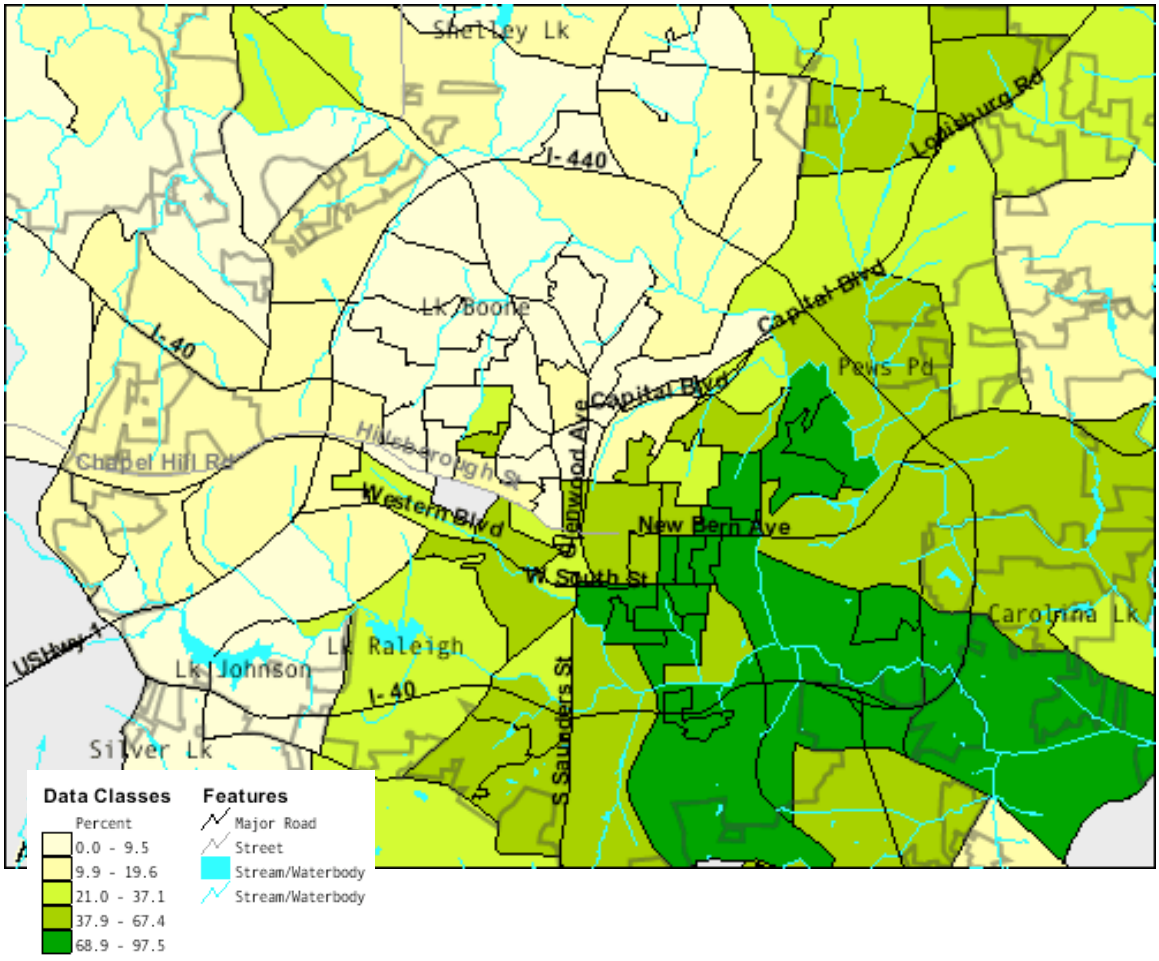


Figure 1-2 Percent per block group of persons who are black or African American alone, Raleigh, NC. Map generated by American FactFinder.

What these maps demonstrate is the extent to which the residents of Raleigh are separated into different parts of the city, and in general, that they are grouped according to their race. Undoubtedly, there are many reasons for this situation; clearly, people often choose to live near their families, who are most often of the same race. People will most likely settle down where they have access to their social and support networks. But this

separation also points to a fundamental difference in quality of housing and infrastructure. There is evidence, which will be discussed below, that this separation does not happen entirely by accident.

These types of inequalities are related to what Donal Muir, in his virulent and perhaps extremist 1993 article, identifies as "kind racism." Distinguishing it from "mean racism" (outright and outspoken hatred of a minority race), Muir argues that "kind racism" is a more subtle and insidious view of racial groups that, because it is more prevalent, is potentially more harmful: "…most of the putative 'non-racists' unreflectively support racist doctrines by using and propagating, for example, by teaching children to 'be nice to blacks,' the racial categories without which racism could not exist" (Muir 1997). In other words, in Muir's view, even the misguided belief that human racial categories are intrinsically biologically based, and that the people who comprise a given race all have certain essential characteristics, constitutes "kind racism." While it is probably more useful to discuss the *societal* shortcomings that cause people to maintain and employ racially detrimental worldviews, the benefit of this approach is that it provides a way to think about how and why our society is still beset with residual Jim Crow inequalities.

In a 2001 AlterNet article, Tim Wise compiles statistics on race relations from a variety of different sources. According to a recent Gallup survey, he reports, only 40% of African Americans believe that they are treated equally in their communities, and 50% of African Americans believe that they have experienced racial discrimination in the past 30 days. He also reports that African Americans are 56% more likely to be rejected for a

mortgage loan (even after controlling for income and other issues), and that nationwide, "mortgage loan rejection rates for the highest income group of blacks is roughly the same as the rejection rates for the lowest income whites" (2001). As Wise explains, surely not every reported instance of racial discrimination is accurate – but even if only 10% of reported claims of discrimination were indeed founded, "this would translate into well over 1.75 million instances of anti-black racial bias every single month, based on survey data."

According to the 2004 report of the National Fair Housing Alliance, instances of housing discrimination, in a variety of forms ranging from the outright denial of pre-purchase access to potential homes or apartments to "discriminatory steering," number in the millions (NFHA 2004). Table 1-1 summarizes the data for each of the ethnic categories reported in that publication.

Table 1-1 Individual instances of housing discrimination for 2003. From the National Fair Housing Alliance

Category	Rental	Sales
African Americans	1,626,000	193,000
Latinos	1,178,315	101,258
Asian Americans and Pacific Islanders	225,291	197,412
Native Americans	175,565	5,561
Totals	3,205,171	497,231

All of this is to say that not only is segregation a reality, and not only are there serious and ubiquitous inequalities between the infrastructure and quality of life of the segregated groups, but that this separation is perpetuated in one way by linguistic

discrimination on the telephone. Linguistic profiling is a quick, easy and nearly undetectable way that landlords and realtors can act on their belief in the biological essentialism of race and thereby maintain the status quo: all it takes is a lie on the phone, a "no," and the problem goes away. For the minority caller, however, the problem only gets bigger.

Some public relations efforts concerning this issue are underway, produced by the NFHA as well as the Ad Council. Figure 1-3 contains a frame from an ad warning people about the reality of linguistic profiling. In a fictional dramatization of recent sociolinguistic scholarship, this advertisement depicts a white man making multiple calls to a landlord who has advertised a vacancy in the paper. In each successive call he speaks in a different minority dialect and uses a corresponding ethnic name – Asian, Latino, Jewish, Arabic, African American, etc. Each time he is told that the apartment has been rented. In the end, when he calls using his white voice, he is told that the apartment is available. While this ad is fictional, it is based on nearly identical studies published in the literature demonstrating the reality of this practice.



Figure 1-3 Frame from an Ad Council commercial

Figure 1-4 contains a print ad developed by the NFHA that shows one way in which the credentials of a person making a telephone inquiry about an advertised apartment could be trumped by their perceived racial category.



Figure 1-4 Fair housing ad created by the National Fair Housing Alliance

Sociolinguistic Application

As will be discussed more in Chapter 2, there is a dearth of phonetic perception studies related to sociolinguistics. In the field of traditional phonetics, perception is a rich and active area of inquiry. These methodologies will also be addressed more

thoroughly in Chapter 2. As it relates to sociolinguistics, ethnic identification experiments such as those presented here can be used to think about language change in many ways. In North Carolina, for example, they have been used to contribute to the ongoing debate on the historical development of AAE by demonstrating the reality of African American accommodation to regional dialect norms in the early 20th century. In these studies, older African American speakers who used regional dialect features were consistently misidentified by experiment subjects as European Americans (Thomas and Reaser 2004b, Thomas 2002). The extremely micro-oriented approach demonstrated in this thesis is related to efforts in determining the salience of specific dialect features. The term *salience*, as it will be used in this thesis – in terms of ethnic identification and as applied to specific features of a dialect – can be conceptualized as the *amount of dialectal weight* that a given feature possesses. If dialects can be discussed not only in terms of the people groups that speak them, but also in terms of the collection of structural features that comprise them, then we should also be able to discuss the *degree* to which each feature is indicative of that dialect.

The logic and justification behind the experiments presented in this thesis is that if listeners think that a given dialect feature is distinctive enough to use to diagnose a speaker as a member of the social group to which the dialect belongs, then that particular feature bears a larger amount of dialectal weight. We will see in the results presented in Chapter 3 and Chapter 4 that for African American speakers, the quality of the vowel /æ/ is more *salient* than that of the vowel /ɛ/, meaning that /æ/ has more dialectal weight.

Chapter 2 – Literature: the nexus of several traditions of research in sociolinguistics

Vowels in African American English

Comprising one of the most thoroughly studied dialects in the United States, the structural features of African American English have been researched for decades. However, according to Thomas (2001), scholars so far have spent less time on vowel variation in AAE, focusing almost exclusively on the dialect's morphosyntactic characteristics. The phonological features of AAE that have been traditionally discussed are generally limited to consonantal characteristics such as *r*-lessness and consonant cluster simplification. For example, even though the comprehensive table of structural features of AAE contained in Rickford (1999) lists 18 characteristic phonological features, only two are related to vowel variation: monophthongization of /ai/ and /oi/ and the pen/pin merger.

On the other hand, early work on vowels in AAE was not non-existent; the tradition of phonetic transcription and impressionistic analysis employed by the various dialect atlases being produced throughout the 20th century necessarily documented certain characteristics of African American vowels. However, the use of narrow phonetic transcription throughout that era has made for a mountain of data that is rather unwieldy and difficult to analyze. One effort to do so comes from George Dorrill, who made an effort to draw some conclusions on the basis of this data about the differences between

the stressed vowels of southern black and white speakers. One of the clearest conclusions provided by his analysis is that in the case of the vowels /i/, /u/, /e/, /o/, and /ɔ/, the African American productions were substantially more monophthongal (Dorrill, 1986).

Partially as a result of the increasing availability of appropriate technology, instrumental analyses of AAE vowels have recently become more and more prominent in the literature. Two 1998 studies by Guy Bailey and Erik Thomas comprise an important initial step into such comprehensive analyses. Using vowel plots made from historical recordings of American slaves, whites, and Caribbean creole speakers, Thomas and Bailey (1998) provide evidence that points to a shared linguistic history between AAE and the Caribbean creole varieties; this paper entailed systematic research into the vowel system of early AAE that was also put to use in Bailey and Thomas (1998). This second article, an overview of the phonology of AAE with an emphasis on vowels, also includes many vowel plots from mid- to late-twentieth century black speakers.

While these studies constitute an initial, substantial investigation into this vowel system, they took as an impetus a comment in Labov (1991). This article maintains that nearly all of the American dialects participate in one of three specific vowel systems. The first, the Northern Cities Shift (henceforth NCS), is restricted to the Great Lakes region of the U.S., and it is characterized by an ongoing rotation of "lax" vowels. Labov's second vowel system, the Southern Shift, is defined by the fronting of the back vowels and a rotation system in the high and mid front vowels. The third system's principal feature is the merger of the low back vowels /ɑ/ and /ɔ/. Labov explains that

despite the near universality of these three vowel systems, the vowels used by African Americans do not appear to coincide with any of them, and that perhaps AAE speakers' vowels should be studied as a "fourth dialect." Evidence for Northern African-Americans' non-participation in the NCS, for example, can be found in Gordon (2000), and Thomas (2001), one chapter of which consists of many AAE vowel plots, provides more support for the existence of this separate vowel system. In this book, Thomas claims that as a result of the fact that the Great Migration took place relatively recently in the 20th century the vowels of African Americans nationwide appear to be fairly uniform.

While the Bailey and Thomas studies are centered on this notion of a "fourth dialect," seemingly conflicting evidence is provided in recent work by Valerie Fridland. Her work in Memphis deals with this question of whether black and white dialects in the South are converging or diverging. By investigating this question with an extensive production study of black and white speakers in Memphis, she addresses the extent to which speakers of each ethnic group are accommodating to the Southern Shift. Her data suggest that both groups are similar in their use of the Southern Shift vowels, albeit to differing degrees, and that Memphis black speakers mark their ethnic identity with the various morphosyntactic features of AAE (Fridland 2003, Fridland and Bartlett 2004).

Results from the studies presented in this thesis seem to point to an important and salient difference in the black and white production of the front vowels. Specifically, the results from Chapter 5 demonstrate that the North Carolina black speakers were not participating in the NCS, nor were they accommodating to the norms of their Southern white counterparts. This finding and others will be discussed more thoroughly in Chapter

6. The vowels examined in the three studies here include the front lax vowels /æ/ and /ɛ/, and they each have a higher realization in comparison to those produced by corresponding white speakers. It's possible that these vowels participate in a chain shift involving /æ/, /ɛ/, and /ɪ/, such that each vowel is realized near or completely within the range of the one above. A similar monophthongal system exists in the dialects found in Australia and New Zealand, something that Americans are being more exposed to as a result of the popularity of feature films from the area such as the Lord of the Rings Trilogy and Whale Rider (this is not to imply that the two systems are related, only to point out a similarity). The literature provides scanty treatment of these AAE vowels. In an early dissertation, Deser's (1990) findings show evidence of identifiable "Southern-sounding" and "Northern-sounding" Detroit black speakers, and the "Northern-sounding" speakers had an /æ/ that was quantifiably higher than that of the "Southern-sounding" speakers. Thomas (2001) posits that all three of the front lax vowels are raised in AAE, and explains that if a difference exists between black and white speakers in this regard, it is as a result of the white speakers' reduced participation in an ongoing shift that both groups historically demonstrated. Further evidence for both raised /æ/ and /ɛ/ can be found in Thomas and Bailey (1998) and Bailey and Thomas (1998); Jones (2000) has evidence of raised /æ/ in Lansing, although it is restricted to a few young working class women and she interprets it as limited accommodation to the NCS raised /æ/.

Perception in Sociolinguistics

The perception of speech is an area of inquiry that is witnessing growing interest in sociolinguistics. As Thomas (2002) explains, in the past perception has been somewhat overlooked by sociolinguists. However, perception may prove to be a fruitful and informative area to investigate, and it will have an important impact on sociolinguistics. There are several levels upon which perception studies can occur, including physical and auditory levels (studies on neural and auditory activity) as well as social levels (studies on group identification and stereotyping). Previous work that has been done in the former includes Janson and Schulmann (1983), who used *synthesized* vowel formants digitally spliced between *recorded* consonants to locate vowel boundaries perceived by listeners from different dialect areas in Sweden. While this type of physical-oriented experimental research on the perception of speech is a well-established method of investigation in laboratory phonetics, only recently has it begun to be fully explored by sociolinguists. The second vein of perceptual research discussed above, concerning less concrete, more socially oriented characteristics of perception, have enjoyed more attention. One early example is Tucker and Lambert (1969), who compared black and white listeners' responses to different dialects by asking them to rate recorded speakers on a series of scales between paired opposites (e.g., educated-uneducated, intelligent-unintelligent, friendly-unfriendly). Articles included in Dennis Preston's volumes on Perceptual Dialectology are examples of the possibilities for the sociolinguistic application of perception research (Preston 1999, Long and Preston 2002). Strand (1999) explores the interaction between visual and auditory perception by

studying how the gender of a "talking face" affects the perception of /s/ and /ʃ/ in CVC syllables synchronized with the images. Similarly, Plichta (2003) found, among many other results, a compelling illustration of ethnic stereotyping when he synthetically matched the same recorded standard speaker with video of white faces and black faces. In response to a question regarding the education level of the stimulus speakers, experiment subjects consistently identified the black speakers that they saw as more educated than the white speakers, even though they were actually *hearing* the standard voice of a white third party. Plichta explains that this result is related to the common belief that if an African American speaks standard, then he *must* be well educated. Other studies include Torbert (2004), recent work by Valerie Fridland, as well as Evans and Iverson's (2004) report on their system of on-the-fly formant resynthesis. This thesis is thematically and financially related to other ongoing projects on ethnic identification at NCSU, including Thomas and Reaser (2004a) and Thomas, Carpenter and Lass (2004). A comprehensive discussion of the possibilities for perception research in sociolinguistics can be found in Thomas (2002).

Linguistic Profiling

Probably the first serious academic investigations into the possibility of linguistic profiling were done by John Baugh. Chapter 6 and Chapter 12 of Baugh (1999) consist of reprinted articles, from 1985 and 1996, respectively. These articles make up an initial step into a scholarly look at linguistic profiling. The 1985 article is a theoretical precursor to the study of linguistic profiling that draws parallels between this and other

types of commonly accepted discrimination. The article also discusses discrimination in a way similar to the Muir (1997) article, arranging the possible types of discrimination on an array of two binary distinctions: overt/covert discrimination, and when the speaker is aware/unaware of the discrimination. He explains that linguistic discrimination can happen in any of these four possible situations. In the 1996 article, Baugh takes these suspicions about linguistic discrimination one step further, and reports on a perception test in which 30-45 second recordings of black and white speakers were played to experiment participants. Listeners were asked to place each recorded speaker on a continuum from Non-Standard English to Standard English, and to identify whether they thought they were white or black. Results showed that those speakers perceived by listeners to be black were spread out all across the continuum; while speakers perceived to be white also showed up at various places on the continuum, most were pushed to the "Standard" end, and none at all were placed on the "Non-Standard" extreme.

Following up on this research, a series of four systematic and empirical experiments concerning linguistic profiling were published in Purnell, Idsardi and Baugh (1999). Using an empirical methodology, in this study the authors took advantage of Baugh's purported tri-dialectal capabilities to test the waters of Real Estate, so to speak. Baugh engaged in a series of calls to designated landlords identified by advertisements in the newspaper. In each call, Baugh used one of his three dialects, Standard English, AAE, and Chicano English; results from these efforts provide clear evidence that landlords were identifying him by his dialect and either turning him down or agreeing to show him the property depending on which dialect he used in the conversation. The

other experiments were follow-up tests to verify the authenticity of Baugh's performances of the dialects. The standard first sentence from the first experiment was played to listeners, "Hello, I'm calling to see about the apartment you have advertised in the paper," as produced by Baugh and other speakers of each dialect. Results indicated that listeners were identifying Baugh's dialects as intended a high percentage of the time. In an effort to consider dialect identification an even more micro level, the researchers then engaged in a second perception test, using only the word "hello" from Baugh's recordings. These results show that overall, experiment subjects were able to accurately identify the intended dialect based only on this single word.

Chapter 3 – A test to examine the salience of /æ/

Methodology

This chapter reports the findings from an experiment designed to examine the salience of /æ/ in two different ways. In a two-part experiment, administered on two different occasions in the spring of 2004, undergraduate students at NCSU were presented with one-word utterances that were solicited and recorded from both African American and European American speakers. In Part 1, listeners heard and responded to 20 stimuli (10 African American and 10 European American), and in Part 2, they heard and responded to 16 stimuli (8 African American and 8 European American)[3]. In both parts, the stimuli occurred in the same phonetic environments for each ethnicity. Listeners heard each stimulus three times, and were given ten seconds to record their responses. A reproduction of the response sheet is included as Appendix A. A random order of stimuli was created for each part, and the same orders were used for both administrations of the experiment.

Creation and selection of stimuli

The stimuli were gathered from recordings made in two different situations. A total of 421 words containing the vowel /æ/ were extracted from recordings made by Erik Thomas and Jeffrey Reaser, and from recordings made by me for a pilot study conducted

[3] Part 2 provides data that will be explicitly compared to data presented in Chapter 4

in the fall of 2003. Only monosyllabic words were considered for stimuli, and words in which the /æ/ was either preceded or followed by a glide or a liquid were excluded from consideration. Additionally, only female speakers were used in order to correct for possible variation in perception based on speaker sex. Cursory formant measurements of these words were taken (1) to verify that the AAE pronunciations of /æ/ are higher and fronter than European American pronunciations, and (2) to permit the selection of stimuli based on instrumental measurements. Mean formant values for the /æ/ tokens produced by the African American speakers and the European American speakers can be found in Figure 3-1. Because the speakers were all female and between the ages of 17 and 27, normalization for physiological differences was not critical.

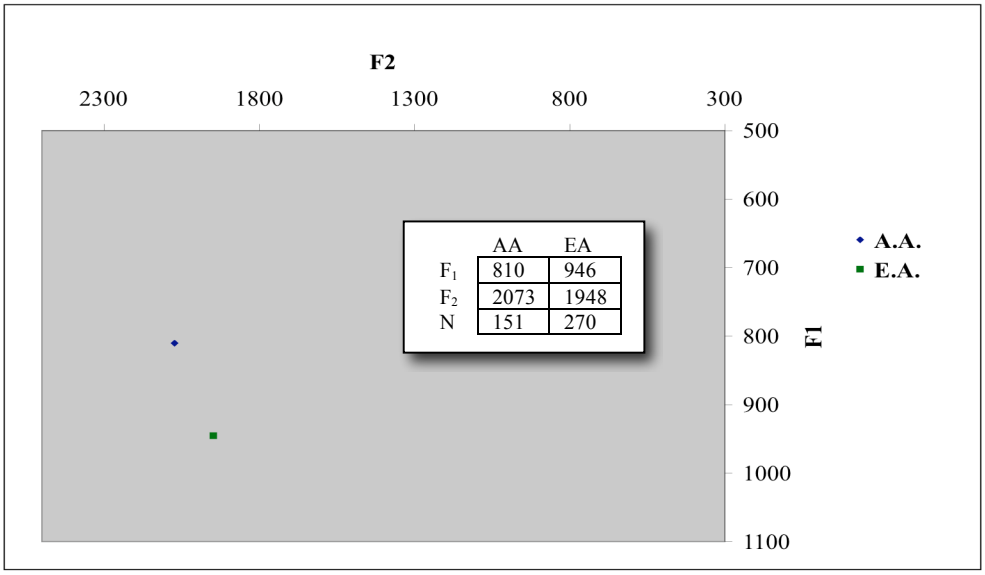


Figure 3-1 Mean /æ/ formant values for each ethnicity

Experiment structure for Part 1

In the first part of the experiment, subjects were presented with 20 digitally recorded, one-word utterances. These words were selected to present the listeners with a possible ambiguity between /æ/ and /ɛ/. As explained earlier, because the AAE pronunciation of this vowel approaches the higher, fronter vowel /ɛ/, words such as *bad*, *sad* and *knack* could be interpreted as *bed*, *said*, and *neck*. Because some results from a pilot study indicated that linguistic information contained in carrier sentences would interfere and affect listener response, this experiment presented each stimulus to the listeners as individual instances of isolated words. Of the words extracted from the source recordings for formant measurement, the ones produced by African American speakers were first checked impressionistically for the AAE realization of the /æ/ vowel. The stimuli used here were not synthetically manipulated. The first and second formant values for those that sounded raised were then mathematically converted to Bark values using the formula in Figure 3-2 (Traunmüller, 1990).

$$Z_x = \left(\frac{26.81}{1 + (1960 \div F_x)}\right) - 0.53$$

Figure 3-2 Equation used to convert formant values to the Bark scale (Traunmüller 1990)

The ten tokens with the highest difference between Z_1 and Z_2 were then selected as the AAE stimuli. Because it is a fundamental characteristic of the vowel space that the

front vowels' F_1 and F_2 show an inverse relation according to vowel height, the difference in F_1 and F_2 (and therefore Z_1 and Z_2) is larger for vowels that are higher and fronter. The Bark scale is a perception measure that accounts for the non-linear way that we perceive frequencies, and Z is the scale's conventionally used variable. In other words, while formants are used as the defining acoustic characteristics of vowel sounds, the Bark scale represents how those characteristics are received and interpreted by our hearing apparatuses (see Johnson 2003 for a thorough discussion of the Bark scale). These ten tokens were checked impressionistically for intelligibility, and those that were difficult to understand (because they were extremely short, or there was coarticulation from neighboring words) were replaced by the next highest tokens on the list. Tokens produced by EA speakers were then sorted so that those with the *smallest* difference between Z_1 and Z_2 appeared at the top of the list. Stimuli were selected from this list in a top-down fashion so that the same wordlist appeared in the EA group as did in the AA group, but with a lower $Z_2 - Z_1$. A graph of the $Z_2 - Z_1$ values for each stimulus can be found in Figure 3-3. Tokens appearing on the left half of the graph are those produced by EA speakers, and those appearing on the right half were produced by AA speakers.

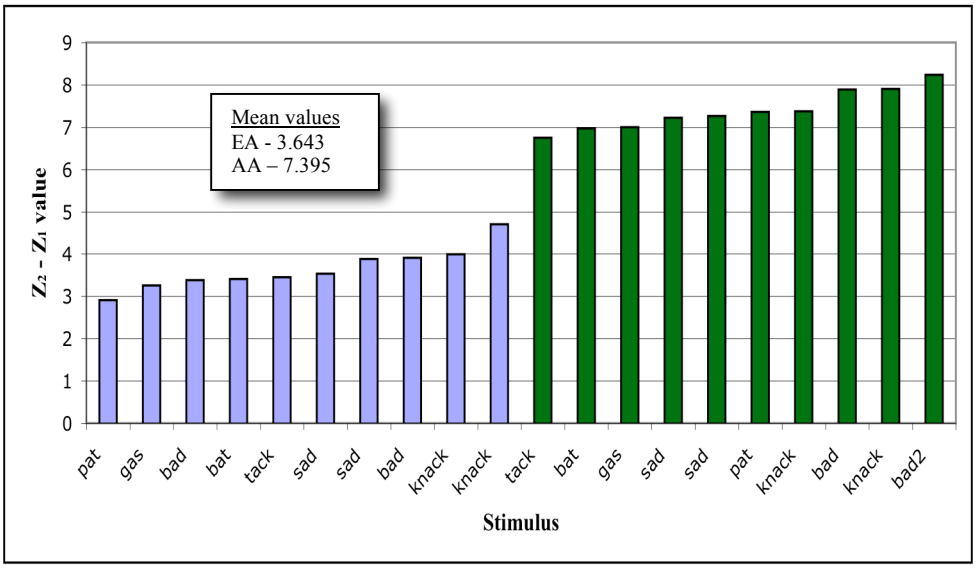


Figure 3-3 Difference in Bark values for each stimulus in part 1

In this section of the experiment, subjects were given two tasks. They were first presented with each stimulus's corresponding minimal pair of possible responses, and asked to circle the word they thought they heard. Because the words were presented to listeners alone, without any context, listeners could be justified in responding with either interpretation. Because this part of the test was designed to collect listener responses in terms of both word choice and speaker ethnicity, the results were expected to reflect the degree to which listeners are aware of /æ/ as a feature of AAE. If listeners are aware that the speaker is African American (from whatever cues happen to indicate it), and in turn choose the word meaning that corresponds to the *lower* of the two vowels in the minimal pair, then the implication would be that raised /æ/ is a feature of African American speech that people are generally aware of. If this is the case, then when listeners perceive

that an African American speaker is European American, they also ought to choose the higher of the words in the minimal pair.

Experiment structure for Part 2

In the second part of this experiment, listeners were presented with stimuli containing /æ/ words that were *not* ambiguous. Words such as *that, cat,* and *pass* do not have a corresponding word with /ɛ/ in English (for example, *thet* has no meaning). Unlike the stimuli in Part 1, in which it was *predicted* that listeners would be able to use available cues to identify the ethnicity of the speakers, an attempt was made in Part 2 to mask the speakers' ethnicities. This was done through a series of three synthetic manipulations. First, timing and rhythm as ethnic cues were controlled for by synthetically setting the vowel duration in each stimulus to 290 ms, a value that is 63 ms longer than the average of all the measured tokens. Second, the first and second formant values in each stimulus were altered using the FormantTier object in the phonetics software Praat. The process of formant resynthesis with Praat is based on the source-filter theory of speech production. According to the source-filter approach, the acoustic characteristics of vowels are determined by the effect that the resonances of the vocal tract have on the periodic sound produced at the glottis. The shape of the oral cavity has the effect of boosting certain harmonic frequencies of the sound source, resulting in the different vowel sounds that we are accustomed to hearing. By positioning our oral cavity into specific configurations, we are able to adjust these resonant frequencies (or *formants*) and reliably generate contrastive vowel sounds (Johnson 2003). Using the

process of *linear prediction* (henceforth *LPC analysis*) to calculate the resonant frequencies (or *formants*) of a recorded vowel sound, Praat is able to create a table consisting of the formant values at each time step through the duration of the vowel in question (this is called the FormantTier object). Through a process of *inverse filtering*, Praat uses the information contained in this table to attenuate the frequencies that had been boosted by the resonances of the oral cavity at the time of the production of the sound, thereby extracting an approximate *source sound* from the recorded signal. Figure 3-4 and Figure 3-5 illustrate the effect that this attenuation process has on the recorded sound. Figure 3-4 contains a spectral slice and an LPC spectrum from a narrow band spectrogram of the pre-extraction sound signal of the vowel /æ/ (as produced by me). F_1 and F_2 are clearly visible here as the first two peaks in the LPC curve. Figure 3-5 is a spectral slice and LPC spectrum from the approximated *source sound,* after the process of formant attenuation. Here we can see that the harmonic peaks in the spectrum show a more regular decay as we move up in frequency, lacking the visible formant peaks illustrated in Figure 3-4.

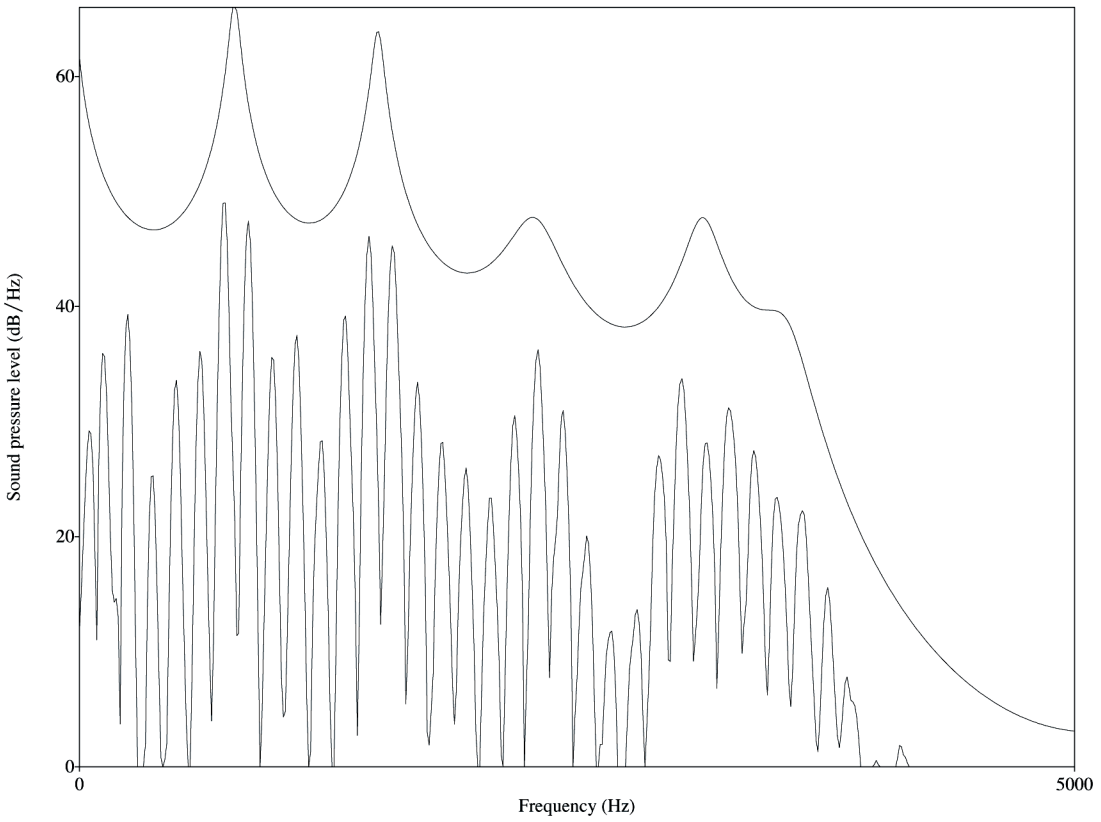


Figure 3-4 Spectral slice from a narrow-band spectrogram of /æ/ (produced by me)

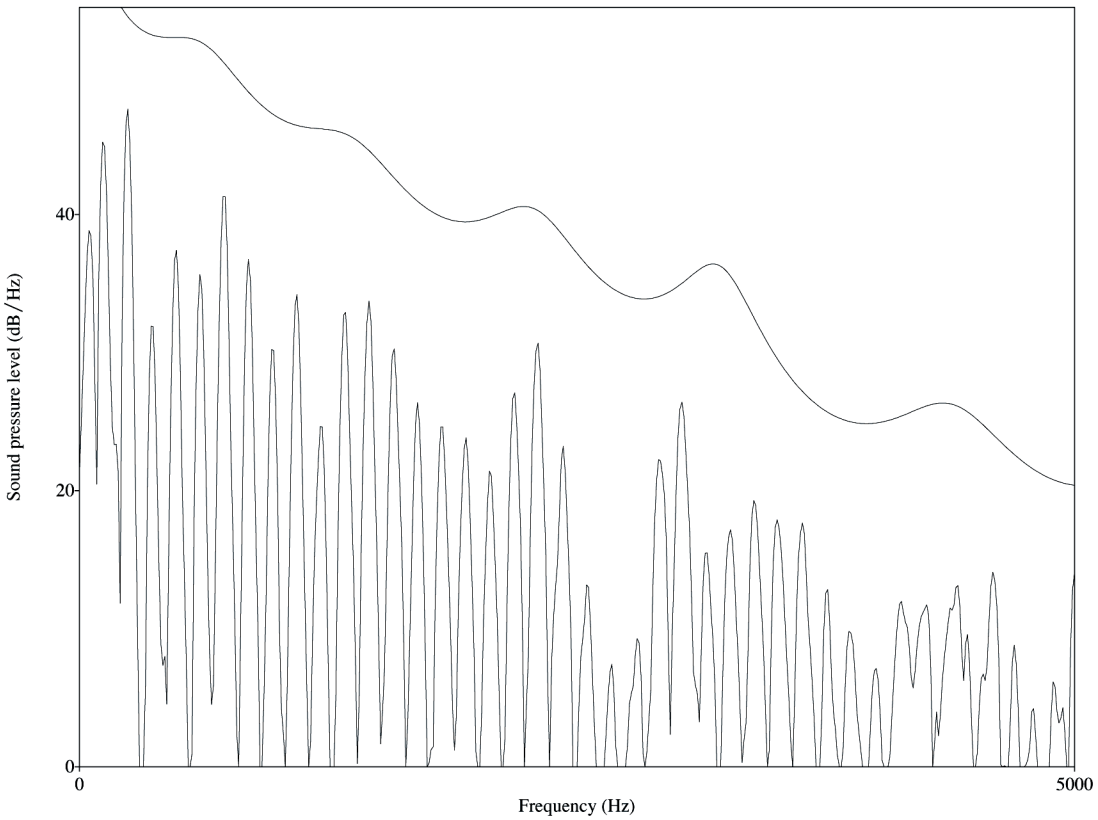


Figure 3-5 Spectral slice of a narrow-band spectrogram from the /æ/ *source* sound, as approximated by Praat from the vowel sound in Figure 3-4

At this point we are left with the approximated *source* sound, illustrated in Figure 3-5, and the original *filter*, represented by the table of resonant frequencies in the FormantTier object. By using Praat to manually change the representative frequencies in the FormantTier object, we can adjust the *filter* to boost the harmonic frequencies in the source signal that correspond to a completely different vowel. By passing the derived *source* through the manipulated *filter*, we can then create a new sound that approximates a different set of acoustic characteristics (Boersma and Weenink 1996).

Using this process it was possible to place each stimulus on one of eight points ranging from /æ/ to /ɛ/. Formant values for these two vowels were based on the measurements for women given in Peterson and Barney (1952), a classic study on vowel formant values. A line between the plotted Peterson and Barney values can be found in Figure 3-6. Using this line's equation, second formant values were calculated based on F_1 values placed at 40 Hz intervals.

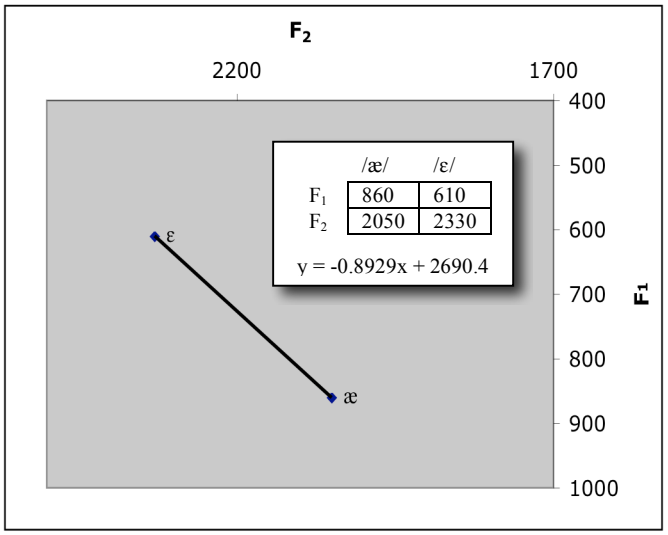


Figure 3-6 Trendline between Peterson and Barney (1952) values for /æ/ and /ɛ/

Table 3-1 contains the values used to create the continuum between these two points.

Table 3-1 Target F_2 values for /æ/ calculated using the trend line

y: F_1	x: F_2
610	2330
620	2319
660	2274
700	2229
740	2184
780	2140
820	2095
860	2050

Using the resynthesis process described above, two tokens were placed at each point on the continuum, one from an AA speaker and one from a EA speaker. Like the stimuli for Part 1, the vowel occurred in the same phonetic environments in the AA group as it did in the EA group. In this case, words were first selected from the EA group, based on the proximity of their F_1 values to the target F_1 values on the continuum. Words were then selected from the AA group that matched those that were selected from the EA group. The third synthetic manipulation performed was monotonization, to control for F_0-related effects on ethnic identification, including key, intonation and jitter. The pitch of each stimulus was set to 200 Hz, which is the mean pitch value for all measured tokens.

It was hypothesized that this continuous arrangement of stimuli would correlate with the percentage of subjects perceiving the speaker to be AA. Speakers whose formants were manipulated to fit in the lower points on the continuum would be

identified by more speakers as EA. Those positioned at the higher points on the continuum would, in turn, be identified by more listeners as AA. It was expected that this would be the case for both AA *and* EA speakers. As we will see, this hypothesis is clearly borne out in the Part 2 results.

Results & Discussion

Since the experiment took place in two parts, the results from each part are presented here in turn, followed by an overall discussion of results from both parts.

Part I

Results from the first part of the experiment were analyzed using a series of 2x2 Chi-Square contingency tables of summed responses (Preacher, 2003). The independent variable in this case was the actual ethnicity of the speakers, represented here by AA (for African American) and EA (for European American). The dependent variables were the word that the listeners perceived, represented here by the IPA symbols $P_{æ}$ and $P_{ɛ}$, and the perceived ethnicity of the speakers, represented by P_A and P_E, for Perceived African American and Perceived European American, respectively.

Independent variables:
AA = African American speaker
EA = European American speaker

Dependent variables:
$P_{æ}$ = Word perceived as containing the higher vowel
$P_{ɛ}$ = Word perceived as containing the lower vowel
P_A = Speaker perceived as African American
P_E = Speaker perceived as European American

Figure 3-7 Defining variables

Table 3-2a, which contains the results sorted by perceived ethnicity and actual ethnicity, demonstrates that the listeners' accuracy at identifying speaker ethnicity is highly significant. This was not unexpected, as it is supported by a host of studies in the literature. What we see in Table 3-2b, on the other hand, contradicts expectations. Here we can see that listeners chose the word containing the vowel /ɛ/ more often when the speaker was AA, and this trend is highly significant. In Table 3-2c, which deals only with responses where the listeners perceived the speakers as African American, we can see that even when they correctly identified the speaker as AA, they still chose the /ɛ/ word with high frequency. This trend is also clearly apparent in Table 3-2d, which shows that when listeners misidentified the African American speakers' ethnicity, they also chose the /ɛ/ word. These results will be discussed later on together with those from Part 2.

Table 3-2 χ^2 contingency tables, broken down by various parameters

a) Part 1 totals: perceived ethnicity vs. actual ethnicity

	AA	EA	sum
P_A	649	91	740
P_E	167	728	895
N.R.	24	21	45
sum	840	840	1680

χ^2=772.403
p<0.0001

b) Part 1: speaker ethnicity vs. perceived word

	AA	EA	sum
$P_{æ}$	186	765	951
$P_{ɛ}$	629	53	682
sum	815	818	1633

χ^2=838.987
p<0.0001

c) Part 1: P_A vs. perceived word

	AA	EA	sum
$P_{æ}$	179	86	265
$P_{ɛ}$	470	5	475
sum	649	91	740

χ^2=155.507
p<0.0001

d) Part 1: P_E vs. perceived word

	AA	EA	sum
$P_{æ}$	7	679	686
$P_{ɛ}$	159	48	207
N.R.	1	1	2
sum	1678	728	895

χ^2=603.588
p<0.0001

Part 2

Results from part 2 were first analyzed in SAS using a 2x2 Chi-Square contingency table of percentages comparing perceived ethnicity with actual ethnicity. Results of this comparison are presented in Table 3-3. The high p-value here indicates that there is little evidence that actual speaker ethnicity had any effect on listener perception. This result implies that efforts to synthetically mask the speakers' ethnicities were successful.

Table 3-3 χ^2 table of percentages for Part 2

	AA	EA
P_A	n=383	n=391
	26.39%	30.01%
P_E	n=269	n=260
	20.64%	19.95%
		p = 0.6278
		χ^2=0.156

Results were then considered using one-way Analysis of Variance to create a table of Least Squares Means for each point on the continuum. Differences between the means were identified using pairwise comparisons. Because of the high p-value mentioned above, it was not considered necessary to examine results from AA speakers and EA speakers separately. Table 3-4 contains the LSMeans for each continuum point. In this case, 0 is "perceived as European American," and 1 is "perceived as African American." A lower number means that more listeners perceived the speaker as EA, and a higher number means that more listeners perceived the speaker as AA. Figure 3-8 is a graphical representation of these results.

Table 3-4 LSMeans for perceived ethnicity for each continuum point

Continuum point	LSMEAN
8	0.83
7	0.82
6	0.80
5	0.73
4	0.62
3	0.49
2	0.22
1	0.24

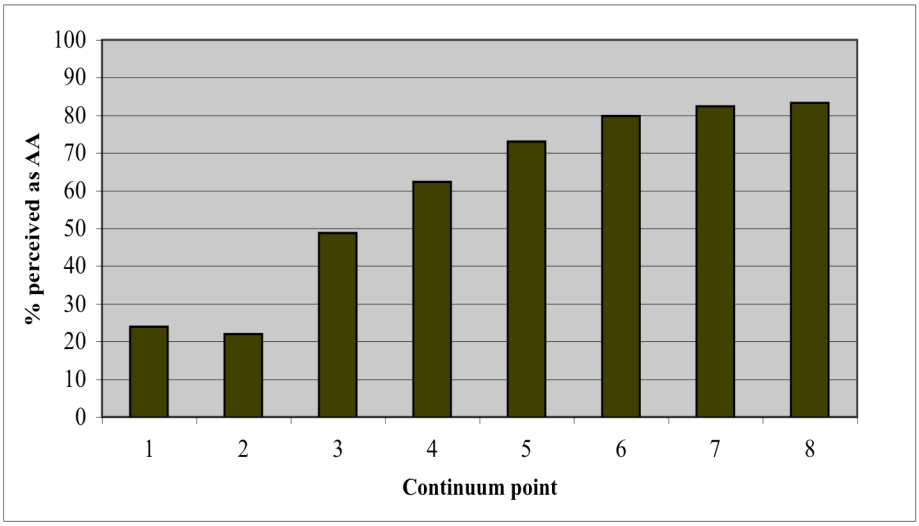


Figure 3-8 Bar graph of Part 2 stimuli perceived as AA

Discussion

The results from the experiment's *second* part provide a clear indication that the AAE pronunciation of the vowel /æ/ is indeed a salient feature of that dialect. Simply put, if the vowel was placed higher on the continuum between /æ/ and /ɛ/, then more listeners identified the speaker as AA. However, the test in Part 1 seems to give conflicting results. Listeners correctly identified the ethnicity of the speakers, but it didn't have an effect on their interpretation of the word they were hearing. This result indicates that because the vowels in those stimuli were indeed closer to the Peterson and Barney (1952) means for /ɛ/ than for /æ/, and because they perceived the words with the higher vowels as the higher word, the vowel quality was more important for the listeners for word interpretation than was the ethnicity of the speaker.

The results from Part 2, on the other hand, show an impressive correlation between vowel height and ethnicity perception. However, the jump to "perceived as AA" seems to take place fairly early as we move up the continuum. Table 3-5 presents the statistical significance of responses to each continuum point in comparison to each other; adjacent continuum points showing a statistically significant difference are shown in boldface type.

Table 3-5 Table of p-values for pairwise comparison of the /æ/ continuum point proportions

	1	2	3	4	5	6	7	8
1								
2	0.679							
3	<.0001	**<.0001**						
4	<.0001	<.0001	**0.0047**					
5	<.0001	<.0001	<.0001	**0.0261**				
6	<.0001	<.0001	<.0001	0.0003	0.1582			
7	<.0001	<.0001	<.0001	<.0001	0.0513	0.5914		
8	<.0001	<.0001	<.0001	<.0001	0.0312	0.4548	0.8316	

We can see here that at the jump from point 2 to point 3, the shift in perception has already begun (see also Figure 3-8). This asymmetry makes sense, however, upon reexamination of the formant values from Peterson and Barney. Figure 3-9 is a post-hoc comparison of the formant values from their study to the cursory average AA and EA formant values for /æ/ that I found in this study.

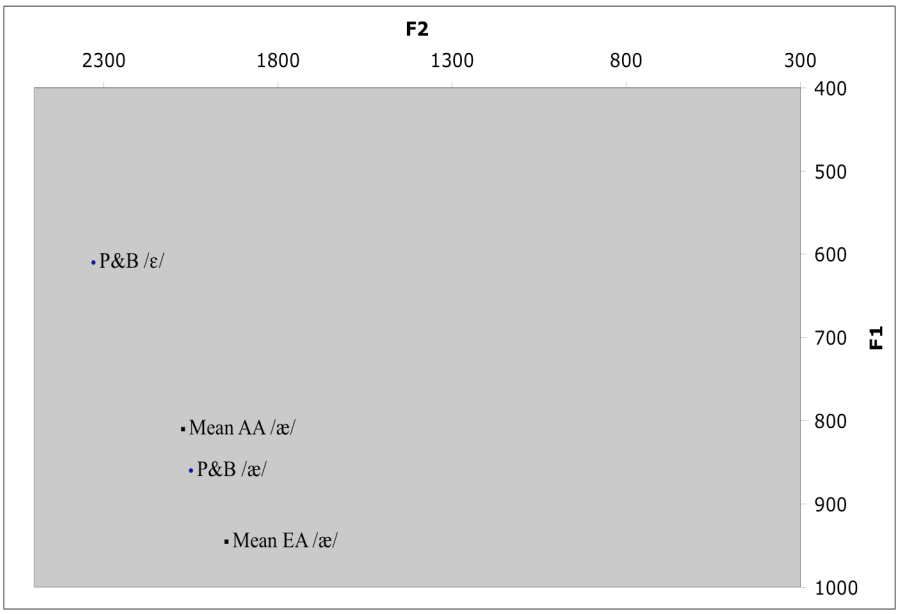


Figure 3-9 Comparison of the mean formant values from Peterson and Barney (1952) for /æ/ and /ɛ/ and my cursory measurements of AA /æ/ and EA /æ/

Given that the bottom of the continuum used for this experiment is at Peterson and Barney's /æ/, then the shift to AA perception should be expected to occur soon thereafter. This seems to show that the P&B data may represent a different dialect – perhaps a better approach for the construction of the continuum would be to use previously measured average /æ/ values for each ethnicity. Another possibility is that the resynthesis procedure itself may have had an effect on these results. The process for formant resynthesis described above creates a degree of synthetic noise on the stimuli, which may or may not have created spurious cues for the listeners. One respondent mentioned that the Part 2 stimuli sounded somewhat "scratchy," which could have made all the stimuli sound more African American. In fact there have been reports in the

literature, including Walton and Orlikoff (1994), which posit that certain noise-related characteristics of speech such as jitter, shimmer, or signal to noise ratio may have an effect on ethnic identification.

Conclusion

In conclusion, it can be argued from the results of this study that the AAE pronunciation of the low front vowel /æ/ is a salient feature of that dialect. Furthermore, a continuum-based approach to the investigation of vowel salience seems to be effective and could be applied to other monophthongal vowels in the AAE vowel system. On the other hand, unless the words can be couched in carrier sentences, perhaps the minimal pair approach used in Part 1 is not as effective.

Chapter 4 – A test to examine the salience of /ɛ/

Methodology

This experiment was designed to test for the perception of the mid front lax vowel /ɛ/, which demonstrates raising in AAE (Thomas and Bailey 1998, Bailey and Thomas 1998, Thomas 2001). While the experimental procedure in this case was virtually the same as that described for Part 2 in Chapter 3, an effort was made to improve the stimuli preparation methodology by addressing the issue illustrated in Figure 3-9. Rather than using the values from Peterson and Barney (1952) to devise the target formant values for this continuum's endpoints, the median of the actual formant values for the collection of stimulus recordings was used.

Creation and selection of stimuli

Speakers were selected from the stimulus recordings based on their scores in a preliminary perceptual test devised to identify which ones sounded the "most African American" and which sounded the "most European American." Formant readings for /ɛ/ were then taken for these speakers, and the median values were used to generate the target formant continuum. Figure 4-1 displays the median values from these measurements, as well as the endpoints used on the continuum: a line equation was calculated using the measured median formant values, and the endpoints for the continuum were selected by using this formula to extend the line past those two values.

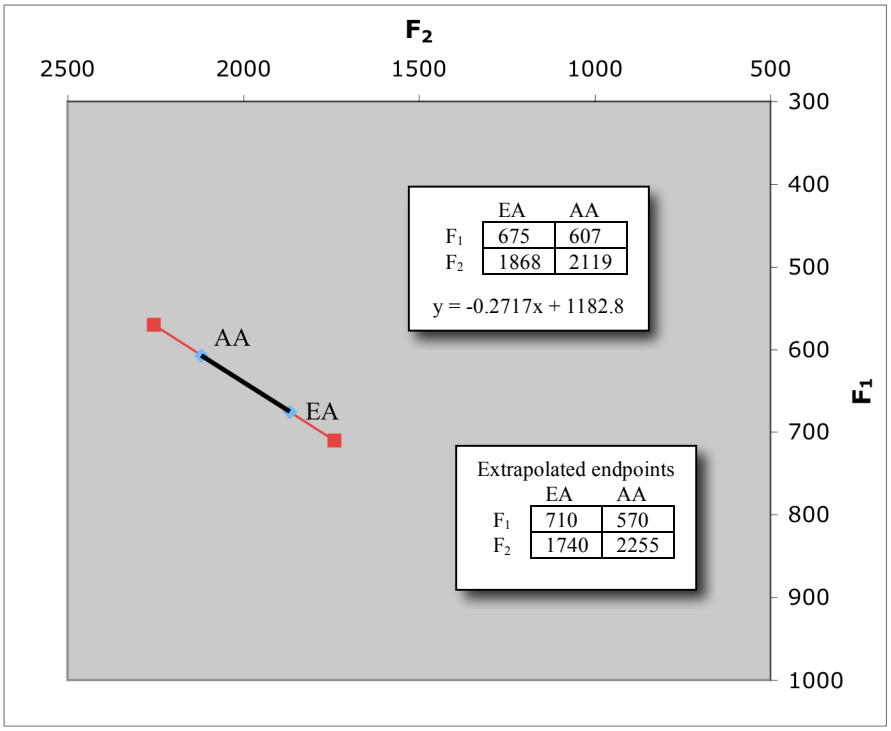


Figure 4-1 Trendline calculated from the median measured values from African American and European American pronunciations of /ɛ/

Table 4-1 lists the actual target values for each of the continuum points. Table 4-2 contains the words that were used to create the stimuli for this segment of the experiment, as well as the continuum point that each represented.

Table 4-1 F_2 values for /ε/ calculated using the trend line

y: F_1	x: F_2
570	2255
590	2182
610	2108
630	2035
650	1961
670	1887
690	1814
710	1740

Table 4-2 Speaker ethnicity and representative word for each /ɛ/ continuum point

Point	Word	Spkr Ethnicity
1	Said	AA
1	Ted's	EA
2	Ted's	AA
2	Next	EA
3	Desk	AA
3	Bed	EA
4	Steps	AA
4	Becky	EA
5	Deb's	AA
5	Said	EA
6	Bed	AA
6	Desk	EA
7	Becky	AA
7	Steps	EA
8	Next	AA
8	Deb's	EA

Experiment structure

The structure of this experiment was nearly identical to Part 2 of the experiment reported in Chapter 3. Just as in that experiment, the subjects here were students in English 210, an Introduction to Linguistics class. They heard stimuli played at the front of the room on loudspeakers, and marked their responses on the response sheet included as Appendix B.

Results and discussion

While the results from this experiment, which are presented graphically in Figure 4-2, are less compelling than those presented in Chapter 3, and there appears to be an anomalous result at continuum point number 2, there is still a correlation between vowel height and the percentage of subjects who perceived the speaker as African American.

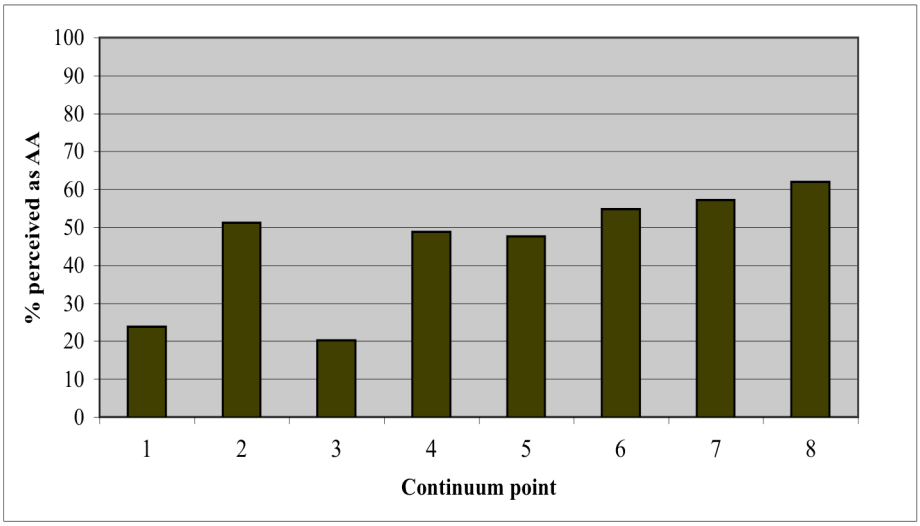


Figure 4-2 Bar graph of /ɛ/ stimuli perceived as AA

These results were analyzed using Analysis of Variance, generating main effect results for the impact that Speaker Ethnicity and Continuum point had on listener response, as well as the effect that the interaction between these two variables had. The results of this analysis are presented in Table 4-3.

Table 4-3 Table of ANOVA-generated p-values for effect on listener response

Independent Variable	p-value
Speaker Ethnicity	0.0447
Continuum Point	0.0001
Interaction	0.8700

Dependent variable: listener response
$\alpha = 0.05$

Here we can see that the main effect for Continuum point (taking the eight points as a whole) is significant and the main effect for Speaker Ethnicity is also significant. However, the main effect for the *interaction* between Speaker Ethnicity and Continuum point is not significant. What this means is that even though the actual ethnicity of the speakers used to create the stimulus recordings had an effect on listener response, it did not have an effect on the change in response percentages between points on the continuum. In other words, the *shape* of the response curve stayed the same, whether the speaker was black or white, but its overall height is higher when the speaker's actual ethnicity was African American.

Table 4-4 is a table of pairwise comparisons for each of the Continuum points. Adjacent points demonstrating a statistically significant difference are presented in boldface type. This table indicates that in a very general way, the stimuli that represented points higher on the continuum were more apt to cause listeners to respond that the speaker was African American. On the other hand, with these results it is impossible to claim that there is a very *strong* correlation between the height of /ɛ/ and listener response.

Table 4-4 Table of p-values for pairwise comparison of the /ɛ/ continuum point proportions

	1	2	3	4	5	6	7	8
1								
2	**0.0002**							
3	0.6294	**0.0001**						
4	0.0008	0.7476	**0.0001**					
5	0.0014	0.6294	0.0002	0.8722				
6	0.0001	0.6294	0.0001	0.4213	0.3346			
7	0.0001	0.4213	0.0001	0.2604	0.1984	0.7476		
8	0.0001	0.1480	0.0001	0.0772	0.0539	0.3346	0.5200	

If we compare the results from this experiment to results presented in Chapter 3, it becomes evident that the raised pronunciation of the low front vowel is a much more salient feature of AAE than is the raised pronunciation of the mid front lax vowel. While statistically the continuum point does seem to have an effect on listener response for /ɛ/, it is not nearly as noticeable as the effect it has on listener response for /æ/ (see Figure 3-8). This conclusion makes even more sense in light of the results from the production study that will be presented in Chapter 5.

The anomalous result at continuum point number 2 remains to be addressed. Reexamination of the two stimuli that represented this point revealed no obvious faults, and post-experimental formant measurements showed that they were within a reasonable range of the target values presented in Table 4-1. While extraneous results such as this can simply be used as support for the idea that /ɛ/ is a less salient feature than /æ/, it is

worth pointing out that the random order used for the presentation of the stimuli placed these tokens at the beginning and the end of the experiment. Perhaps the seemingly random results can be attributed to subjects' lack of concentration at the beginning of the procedure, and fatigue or frustration at the end. A second possible explanation for this result is related to one of the words selected to represent that particular continuum point, which can be found in Table 4-2. In the word *next,* the vowel in question occurs post-nasally; nasality results in extra nasal formants, formants with large bandwidths (making the central tendancy of the formant indeterminate), and formants that are canceled altogether. This may have interfered with the formant resynthesis process, as well as with the listeners' perception of the vowel, causing the results to be skewed. Either way, it is clear that the less organized results produced in the second experiment (as compared to the more regular results from the first) serve to reinforce the notion that raised /æ/ is a much more salient feature of AAE than is /ɛ/.

Further support for this comes from the pre-experimental formant measurements used to generate the continuum for /ɛ/. We can see in Figure 4-1 that the difference in median F_1 frequency is much more superficial as compared to the difference found between the median F_1 values for /æ/ (which are in Figure 3-9). If these formant measurements indicate that the two pronunciations of this vowel, while certainly different, are not extremely far apart, then perhaps the fact that there is not a strong correlation in the responses to /ɛ/ is to be expected. /ɛ/ in AAE is indeed higher than in

the English used by most Southern white speakers, but perhaps it is not quite high enough to be a salient and diagnostic feature of the dialect.

So, in conclusion, these experimental results provide evidence that both of these vowel variants are salient features of AAE; however, /ɛ/ is much less salient than /æ/. These results also provide evidence that in general, vowel quality plays an important role in ethnic identification.

Chapter 5 – Adventures in instrumental analysis: /æ/ and /ɛ/ as produced by North Carolina black and white speakers

Intro

The experiments reported in the previous chapters were conducted under the assumption that AA speakers do in fact produce the vowels in question higher than their EA counterparts. While the cursory vowel measurements taken for the first experiment, as well as other extant scholarship, support this assumption, there has not yet been a systematic empirical investigation of the divergence. The study reported in this chapter, which was completed with Libby Coggshall and Melissa Damann as a group project for a course in Phonetics at UNC-CH, was intended to provide such evidence.

Methodology

Speakers

The speaker selection process for this project was fairly straightforward. We combed through the corpus of sociolinguistic interviews in the William C. Friday Linguistics Lab at North Carolina State University, selecting only recordings from Hyde, Robeson, and Warren counties and consciously avoiding speakers from the Outer Banks and the Appalachian Mountains. In order to keep external variables such as age and sex to a minimum, we selected only females born between 1974 and 1986 in these three counties. An effort was made to balance the ethnicities for each county. A total of

twelve AA speakers and eleven EA speakers was used. Table 5-1 lists each speaker's initials, ethnicity, county of residence, and year of birth.

Table 5-1 Speakers

Speaker	Ethnicity	County	Year of Birth
A.CW.	EA	Hyde	1979
D.E.	EA	Hyde	1976
J.C.	EA	Hyde	1983
S.SP.	EA	Hyde	1980
S.W.	EA	Hyde	1975
G.L.	EA	Robeson	1974
K.R.	EA	Robeson	1978
A.CP.	EA	Warren	1979
C.E.	EA	Warren	1984
L.C.	EA	Warren	1983
L.W.	EA	Warren	1984
A.S.	AA	Hyde	1986
C.S.	AA	Hyde	1983
J.S.	AA	Hyde	1983
L.S.	AA	Hyde	1983
M.S.	AA	Hyde	1975
S.M.	AA	Hyde	1986
SF.S.	AA	Hyde	1981
A.B.	AA	Robeson	1983
L.J.	AA	Robeson	1975
L.M.	AA	Robeson	1974
J.D.C.	AA	Warren	1978
J.D.	AA	Warren	1983

The interviews were recorded in the 1990s on cassette tapes. The interviewers were staff members of the North Carolina Language and Life project (either faculty, graduate students or locals who conducted interviews). The interviews were conducted

in places comfortable for the interviewee, such as their kitchens or front porches, or even while walking around town. Each interview (excluding CE) lasted between 45 and 80 minutes.

Procedure

Some of the cassette tape recordings had been previously digitized at a sampling rate of 20 kHz using the Kay CSL Model 4300B in the NCSU Linguistics Lab, where they were manually segmented into five minute clips, leaving about a two-second overlap between each segment. Those that had not yet been digitized were dubbed to CD as a single track at a sampling rate of 44100 Hz using a TASCAM CC-222 dubbing machine. These newly dubbed audio tracks were then loaded into Praat as LongSound objects and subsequently run through a Praat script that divided them up into five-minute segments with five-second overlap between the segments. This Praat script can be found in Appendix C.

Once the interviews were digitized, we started measuring the first formant of the vowels /æ/ and /ɛ/ using Praat's formant tracker. Because the second formant in the vowels /æ/ and /ɛ/ is relative to the first formant, it was necessary only to consider F_1, which corresponds to vowel height. We did not use any tokens from the first five minutes on the tapes, assuming that the interviewees would need some time to get comfortable and speak naturally. Listening attentively, we selected words that contained the vowels we wanted; because of the coarticulatory effects that they have on formant structure, we avoided any vowel tokens whose environment contained liquids, nasals, or

/w/. We also avoided the lexically peculiar word "get," which is often pronounced /gɪt/ instead of /gɛt/ in the South.

The tokens were then highlighted from beginning to end, as ascertained by the listener. We looked for certain cues on the spectrogram, such as stop bursts, the cessation of frication, etc., but the quality of the recording occasionally clouded our view of these visual cues. In those cases, we often had to depend on listening to the token to determine the start and end points.

Our formant tracker was set to look for either four or five formants under 5500 Hz, depending on which setting gave us less anomalous results (such results showing up as seemingly random formant dots in between obvious formants). Using a Praat script, we recorded the speaker, the ethnicity of the speaker, the vowel, the word, the file name, the number of formants on the setting, the beginning point of the vowel, the end point of the vowel, the midpoint of the vowel, the duration of the vowel, and the first three formant measurements at the midpoint. The script, which can be found in Appendix D, put all of the information into a tab delimited text file that was imported into an Excel spreadsheet after the measurements were taken.

Ten tokens each of /æ/ and /ɛ/ were used in the final analysis for each speaker. Often we measured several more than ten each. Occasionally, a speaker simply did not speak enough during the time of the interview to be able to produce enough tokens. If this was the case, we sometimes included tokens that violated our environment rules in order to have a large enough number. We took approximately 415 measurements, but were forced to throw out around 80 because of either obviously faulty readings or

researcher error. We also used formant measurements for five speakers taken by other NCLLP researchers. All of the data, some 446 measurements, were compiled into one massive Excel spreadsheet and taken over to the statistical consultants at UNC's Odum Institute for data analysis.

Results

The data collected using the above methodology were analyzed using ANOVA adjusted for multiple observations within subjects. Because we did not have the same number of subjects in each ethnicity group, our statistical consultant advised us to use the *score* statistic, which has a χ^2 distribution under the null hypothesis. This approach allows for variability in the number of observations across categories. Figure 5-1 contains our null and alternative hypotheses; the hypotheses we used for both of our tests (for /æ/ and /ɛ/) had the same form.

$$H_0: \mu_1 - \mu_2 = 0$$
$$H_a: \mu_1 - \mu_2 \neq 0$$

Figure 5-1 Null and alternative hypotheses

Using the *score* statistic, we considered the significance of two contrasts. In other words, for the vowels /æ/ and /ɛ/, we used a statistical procedure to find the significance of the difference between each ethnic group's mean F_1 value. The first was the contrast between the F_1 means for each ethnicity within the vowel /æ/. The χ^2 value for this

contrast was $\chi^2_{(æ)} = 13.73$, generating a p-value of .0002. The second was the contrast between the F_1 means for each ethnicity within the vowel /ɛ/. The χ^2 value in this case was $\chi^2_{(ɛ)} = 7.85$, with a p-value of .0051. These results are summarized in Table 5-2.

Table 5-2 Calculated χ^2 values for the contrasts between ethnicities for each vowel, along with the corresponding p-values

Contrasted vowel	χ^2	p
/æ/	13.73	.0002
/ɛ/	7.85	.0051

The five-number summaries for each of the contrast groups are presented in boxplot format below in Figure 5-2.

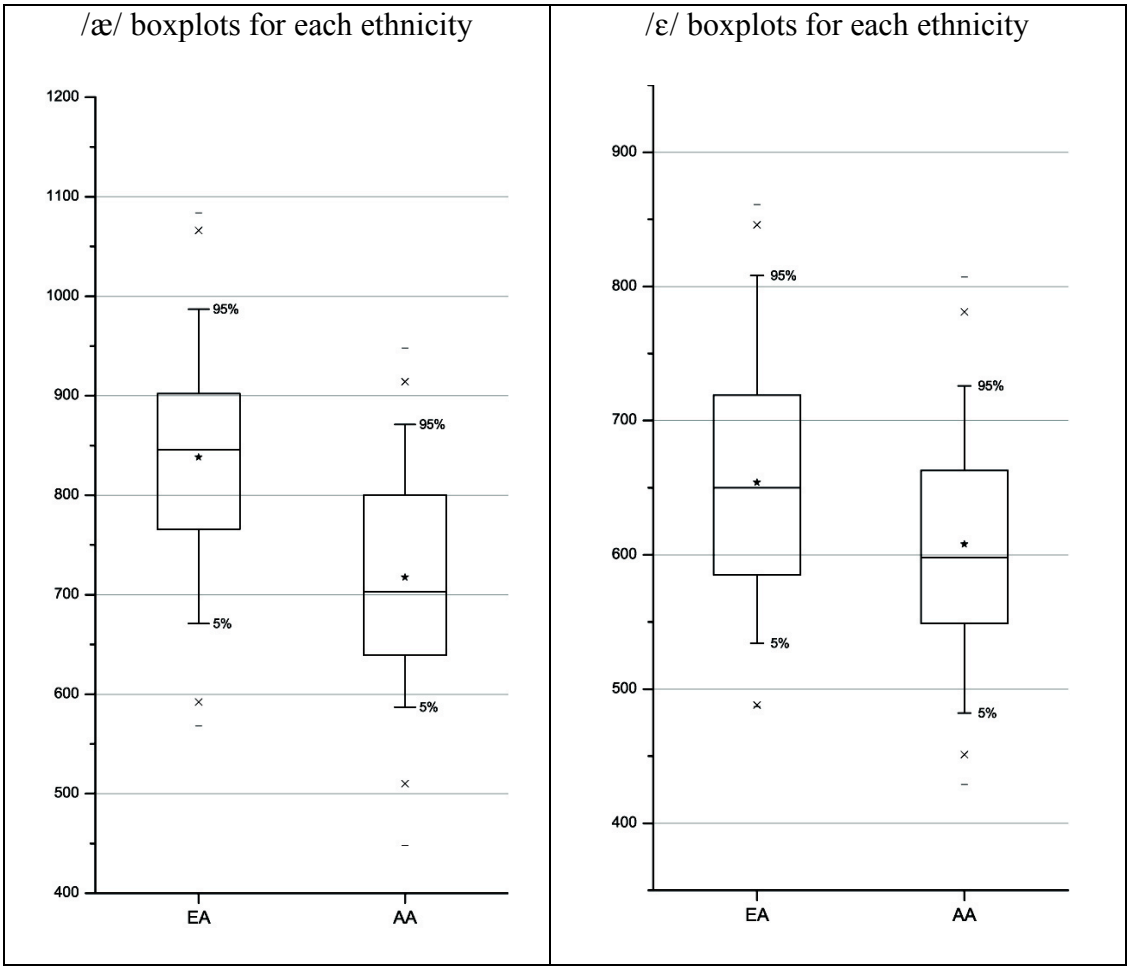


Figure 5-2 Boxplots for the /æ/ and /ɛ/ results for each ethnicity

The F_1 means for each vowel and for each ethnicity are presented in Table 5-3.

Table 5-3 Mean F_1 values for each ethnicity and vowel

	Mean /æ/	Mean /ɛ/
AA	717 Hz	608 Hz
EA	838 Hz	654 Hz
Dif	*121 Hz*	*46 Hz*

Figure 5-3 shows 95% confidence intervals for each ethnicity's mean value in each vowel class.

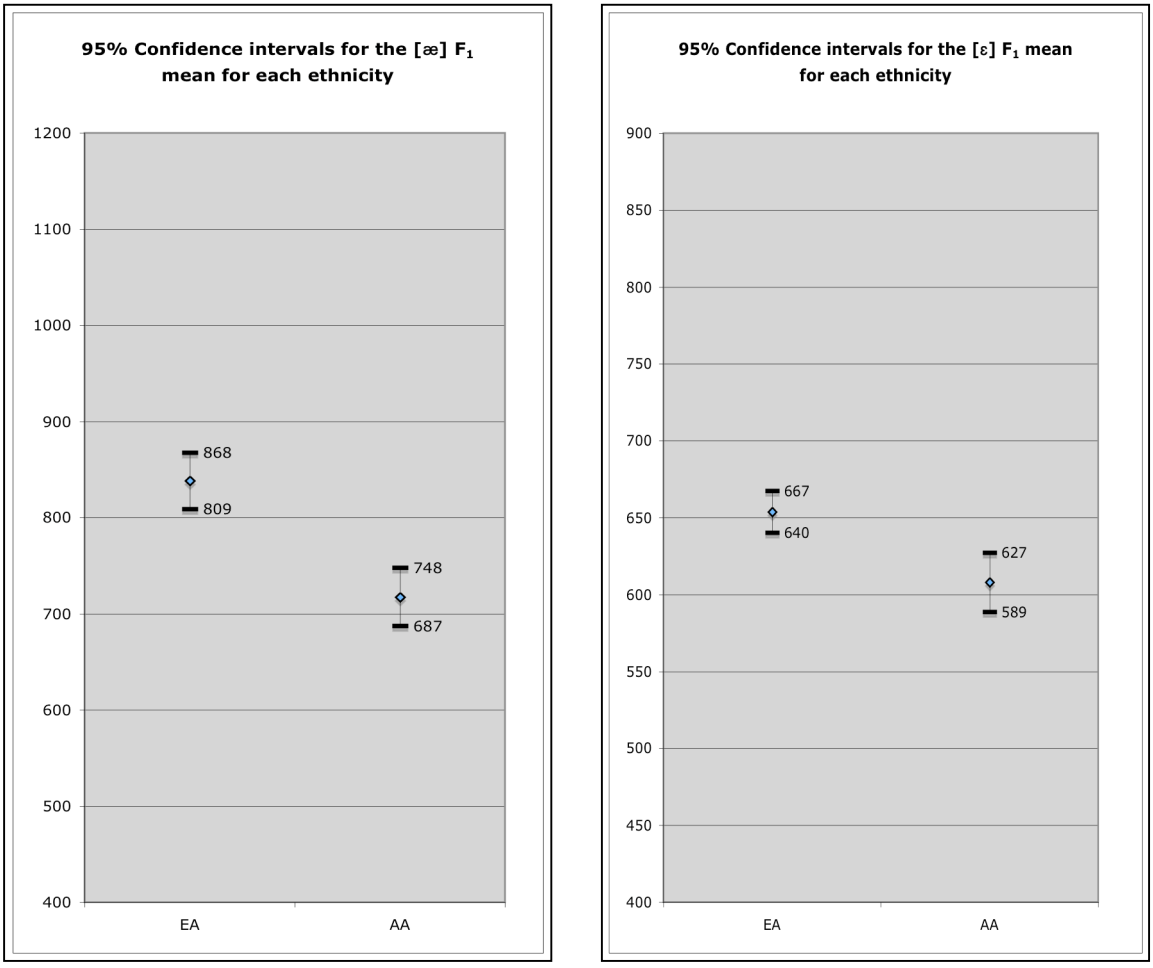


Figure 5-3 95% confidence intervals for each ethnicity's mean value in each vowel class

Discussion

Findings

The statistical tests described above provided us with sufficient evidence to reject the null hypothesis. In other words, there is evidence of a difference in the F_1 mean for both vowels between AA and EA speakers. With a mean F_1 for /æ/ of 717 Hz for AA vs. 838 Hz for EA and a mean F_1 for /ɛ/ of 608 Hz for AA vs. 654 Hz for EA, our data support our hypothesis that for the communities examined, /æ/ and /ɛ/ are higher in AAE than in the English used by most EA speakers. Furthermore, the difference in the two ethnic means for /æ/ (121 Hz) is more highly significant than the difference in the means for /ɛ/ (46 Hz). This could be caused by an ongoing diachronic process in which the upward movement of /æ/ in the AA speakers is a more established feature, subsequently causing the /ɛ/ to move upward as well. On the other hand, Thomas (2001) points out evidence that EA speakers are currently retreating from previous tendencies to exhibit /æ/ raising. Taken together, these two phenomena provide support for the notion of an increasing divergence in AA and EA speakers regarding these vowels, which is also pointed out in Thomas and Bailey (1998). More investigation into the nature of this divergence will be an enticing and interesting avenue for further research. At any rate, based on our analysis, both of the mean differentials are statistically significant.

Limitations

While I am confident of our results, no study is perfect. Especially when extracting data from a pre-existing corpus, certain limitations may have a potential effect on the study. For example, the quality of the field recordings is not consistent across the interviews. None of the interviews was conducted in a soundproof booth so all of the spectrograms had at least some "grass" and interference; this made them more difficult to read than a spectrogram from a pristine recording. However, some of the recordings were particularly difficult to deal with due to extreme background noise. In some of the recordings, one could hear televisions blaring, air conditioners blowing, birds chirping, phones ringing, kids talking or crying, or wind blowing. Sometimes the interviewers would talk over the respondent or laugh while the respondent was talking. Because of these interferences, identified tokens sometimes had to be passed over if the background noise obstructed the measurements.

Moreover, some social factors affected the amount of speech production in our recordings. Many times people would talk for or over the person we were trying to measure. Also, some subjects seemed uncomfortable talking in front of another person present during the interview (i.e. a father, an uncle). This affected the total amount of speech, hence the number of tokens, that we had to choose from.

Because the interviews were conducted by a range of people (some graduate students, a professor, some externally-hired people), the interviewing styles varied between the recordings. Some interviewers asked mainly "yes or no" questions and

seemed unable to draw the subjects out. Again, this affected the total amount of speech produced.

Another limitation of this study has to do with the total number of speakers. For the optimal study design for this type of experiment, we were advised to maximize the number of speakers, taking only a few tokens from each. Because we were working with pre-existing recordings, our corpus was limited by the number of speakers in the NCLLP archives who fit our selection criteria.

Finally, regional variation could affect the results of our study. We tried to control for the variable of region by selecting the same number of AA speakers and EA speakers from each North Carolina county. While we were limited by what was in the corpus, we controlled for this fairly well by using 7 AA vs. 5 EA speakers from Hyde county, 3 AA vs. 2 EA speakers from Robeson county, and 2 AA vs. 4 EA speakers from Warren county.

Chapter 6 – Conclusions

In this thesis, I have reported on two perception experiments and one production experiment concerning the front lax vowels /æ/ and /ɛ/ in African American English. The vowel system of AAE, unlike other structural features of the dialect, is represented in the literature only by a relevantly small number of studies. Therefore, the purpose of the production experiment reported in Chapter 5 was to contribute to this literature by empirically addressing a part of that system, the height of the vowels mentioned above. As discussed in Chapter 2, one of the questions concerning African American vowels has to do with whether or not they represent a separate vowel shifting pattern, unaffiliated with any of the three base American systems identified by Labov (1991) (see Chapter 2). Results from this study provide evidence of an ongoing phonetic divergence among North Carolina black and white speakers. This divergence speaks to the "fourth dialect" question by demonstrating that African American speakers in North Carolina do not accommodate to the white norm in regard to the front lax vowels. While the vowels in question do not play a part in Labov's Southern Shift, the fact that there is a divergence is important, because it gives evidence of a different system altogether.

Because one of the most noticeable features of the Northern Cities Shift is the raising and fronting of /æ/, one could posit that the results from Chapter 5 in fact show that these AA speakers were matching the NCS norm. After all, recent studies in North Carolina have demonstrated how young African Americans, in an effort to align themselves with a larger African American culture, have had a tendency to drop regional

dialect features in favor of nationwide African American norms (i.e., Wolfram and Thomas 2002). Perhaps this raised /æ/ is merely evidence that the NCS has been adopted by this larger community, and as members of that community the North Carolina speakers are using it. However, there are three reasons that can be taken from this thesis that the /æ/ raising as realized by African Americans in North Carolina is different than the raising present in NCS speakers. The first comes from the Chapter 5 finding that /ɛ/ is also higher in the AA speakers. /ɛ/ is not raised in the NCS; indeed the opposite is true. The fact that both /æ/ and /ɛ/ are raised in the black speakers seems to point more to the presence of a chain shift involving these vowels, along with /ɪ/. Secondly, while the NCS raised /æ/ is characterized by a schwa offglide, such that the realization is more like [eə], the /æ/ used by the AA speakers in this study was almost categorically monophthongal, being more like [ɛ] in realization. While this finding contrasts slightly with findings from Gordon (2000), his results corroborate with these in the sense that in both cases, /æ/ raising by AAE speakers differs from the /æ/ raising found in Northern white speakers. Deser (1990) and Jones (2000), on the other hand, interpreted their evidence of /æ/ raising in AAE as accommodation to the Northern white norm. Finally, there is some historical evidence, in Thomas and Bailey (1998), that late 19th century AAE speakers exhibited a raised /æ/; instead of changing to match the norm of the NCS, it is more likely that these AAE speakers are merely staying where they have historically been. Furthermore, Thomas (2001) explains that white speakers in the south seem to be

showing a gradual lowering of this vowel. The results from Chapter 5, which show a profound difference in this vowel across the two ethnic groups, together with Thomas and Bailey's findings, seem to support the conclusion that if a divergence is taking place, then it is due not only to an intensifying of /æ/ raising and /ɛ/ raising in AAE, but also to an ongoing lowering in the white speakers.

In light of this, the results from Chapter 3 and Chapter 4 can be discussed in several different ways. When considered in tandem with the production study, findings from these chapters point to the importance that each vowel shift holds for AAE. We have clear evidence from Chapter 5 that North Carolina AAE speakers do indeed raise /æ/, and we have clear perception evidence from Chapter 3 that this vowel shift is indicative of an African American speaker. The same goes for /ɛ/: we have evidence from Chapter 5 that the /ɛ/ used by the black speakers is higher than that used by white speakers, and we have evidence from Chapter 4 that listeners use this feature to identify the speaker's ethnicity. By comparing the /æ/ results from both the perception study and the production study to the corresponding results for /ɛ/, I can say confidently that raised /æ/ is a feature of AAE that is salient, and it is also substantially more salient than raised /ɛ/. While the results regarding /ɛ/ from both the production experiment *and* the perception experiment constitute statistical significance, the /æ/ results were much more compelling. In other words, the difference between /æ/ height as produced by AA and

EA speakers is greater than the difference between /ɛ/ height, and, correspondingly, there is a greater degree of salience for AAE exhibited by raised /æ/ than by raised /ɛ/.

The purpose of the experiments presented in this thesis was not only to demonstrate the reality of ethnic divergence in the front vowels, but also to provide evidence for the plausibility of linguistic profiling by showing that a speaker's racial identity can indeed be identified even with a paucity of linguistic information. The results from these studies have far-reaching implications for linguistic profiling, especially as it relates to the housing market. We have seen from the perception studies that listeners need only a miniscule amount of linguistic information in order to make a judgment regarding the ethnicity of a speaker. Furthermore, as far as /æ/ is concerned, perception results indicated that there was a high degree of consensus concerning this vowel's importance for AAE.

Other Considerations

While it is clear that this research has produced important and useful quantitative results, it is necessary to briefly discuss some less tangible issues that have come up in the process. First of all, as a result of a social environment that is becoming more tolerant of varieties of people, students seem to be suspicious of any endeavors that focus on nominal ethnic differences. And rightfully so. Because of a long and rocky history of race relations in the South, discussions of African Americans here have the effect of quickly triggering sensitivities and objections among students. In other words, because the African American struggle is situated more squarely in the focal point of the Southern

college student's psyche, be they black or white, it is difficult to discuss anything racially oriented without having the effect of raising some red flags. Perhaps this is because in the mind of the Introduction to Linguistics students (who served as subjects for these experiments), whose social awareness and dialect awareness are incipient, acknowledgment of *linguistic* difference can be equated with justification of *social* difference. Many people, minority or not, remain sensitive when it comes to talking about ways in which dialect can be aligned with racial categories. As discussed in Wolfram (2003), this became crystal clear after the media explosion concerning the Ebonics issue, when many Americans balked at the notion that any real respect should be paid to the type of language used by many African Americans. In another example, O.J. Simpson defense attorney Johnny Cochran became extremely offended at even the *suggestion* that a connection could be drawn between language and race. While sociolinguists understand that dialects are a natural feature of the way in which languages evolve, as a result of the realities summed up by the *Principle of Linguistic Subordination* (Lippi-Green 1997, Wolfram 2003) the American public is much more likely to view variety in language as indicative of social and intellectual incompetence. As a result, for many Americans, to acknowledge the *existence* of the possibility of linguistic profiling is to acknowledge a link between ethnicity and language, which they feel is racist. This is one of the many reasons why it is imperative that sociolinguistics become more actively engage in public education about dialects.

In no way does all of this indicate that race (or ethnicity) is a topic that scholars should avoid. For our purposes as researchers in sociolinguistics, ethnic identification,

and linguistic profiling, these responses merely underscore the importance of clarifying for the experimental subjects (after the administration of the experiment) the ultimate purpose of such research. As sociolinguists we work under certain assumptions: it is clear to *us* that what we are doing (i.e., tracking and documenting language variation) should be considered an innocuous and enthusiastic *celebration* of human variety. We assume that we are open-minded individuals, sensitive to the problems that stem from differences. We also often perhaps naively assume that other people understand this. However, we must take steps to mitigate the potential offensiveness of these types of "people-sorting" experiments. This requires clearly explaining the usefulness of the resultant data in terms of linguistic profiling, as well as using it to reference and instigate discussions about dialect awareness.

Reference List

American Factfinder. Retrieved Feb. 1, 2005, from http://factfinder.census.gov

Bailey, G., & Thomas, E. R. (1998). Some aspects of African-American vernacular English phonology. In S. S. Mufwene, J. R. Rickford, G. Bailey & J. Baugh (Eds.), *African-American English: structure, history, use*. New York: Routledge.

Baugh, J. (1999). *Out of the mouths of slaves: African American language and educational malpractice*. Austin: University of Texas Press.

Baugh, J. (2003). Linguistic Profiling. In S. Makoni, G. Smitherman, A. Ball & A. K. Spears (Eds.), *Black linguistics: language, society, and politics in Africa and the Americas*. New York: Routledge.

Boersma, P., & Weenink, D. (1996). *Praat, a system for doing phonetics by computer*. Retrieved March 9, 2004, from http://www.praat.org

CNN. (2000). *Dr. Bob Jones III discusses the controversy swirling around Bob Jones University*. Retrieved Feb. 24, 2005, from http://transcripts.cnn.com/TRANSCRIPTS/0003/03/lkl.00.html

Deser, T. (1990). *Dialect transmission and variation: an acoustic analysis of vowels in six urban Detroit families.* Unpublished dissertation. Boston University, Boston.

Dorrill, G. (1986). A comparison of stressed vowels of black and white speakers in the South. In M. Montgomery & G. Bailey (Eds.), *Language variety in the South: perspectives in Black and White*. Tuscaloosa: University of Alabama Press.

Evans, B. G., & Iverson, P. (2004). Vowel normalization for accent: an investigation of best exemplar locations in Northern and Southern British English Sentences. *Journal of the Acoustical Society of America, 115*, 352-361.

Fridland, V. (2003). Network strength and the realization of the Southern Vowel Shift among African Americans in Memphis, Tennessee. *American speech, 78*, 3-30.

Fridland, V., & Bartlett, K. (2004). *What we hear and what it expresses: the perception and meaning of vowel differences among dialects.* Paper presented at LAVIS III, Tuscaloosa.

Gates, E. N. (1997). *The concept of "race" in natural and social science*. New York: Garland.

Gordon, M. J. (2000). Phonological correlates of ethnic identity: evidence of divergence. *American speech, 75*, 115-136.

Janson, T., & Schulman, R. (1983). Non-distinctive features and their use. *Journal of linguistics, 19*, 321-336.

Johnson, K. (2003). *Acoustic and auditory phonetics* (2nd ed.). Malden, MA: Blackwell.

Jones, J. (2000). *Imperceptible change: the vowel system of African Americans in the urban North.* Paper presented at NWAV 29, East Lansing.

Labov, W. (1991). The three dialects of English. In P. Eckert (Ed.), *New ways of analyzing sound change* (pp. 1-44). New York: Academic Press.

Lewontin, R. C. (1997). The apportionment of human diversity. In E. N. Gates (Ed.), *The concept of "race" in natural and social science* (pp. 7-24). New York: Garland. (Reprinted from *Evolutionary biology,* 6, 381-398, 1972).

Lippi-Green, R. (1997). *English with an accent: language, ideology, and discrimination in the United States*. New York: Routledge.

Long, D., & Preston, D. R. (Eds.). (2002). *Handbook of perceptual dialectology* (Vol. 2). Philadelphia: John Benjamins Publishing Company.

Muir, D. (1997). Race: The mythic root of racism. In E. N. Gates (Ed.), *The concept of "race" in natural and social science* (pp. 93-104). New York: Garland. (Reprinted from *Sociological Inquiry,* 63, 339-350, 1993).

NFHA. (2004). *2004 fair housing trends report*. Retrieved Feb 1, from http://www.nationalfairhousing.org

Omi, M., & Winant, H. (1994). *Racial formation in the United States: from the 1960s to the 1990s* (2nd ed.). New York: Routledge.

Peterson, G. E., & Barney, H. L. (1952). Control methods used for the study of the vowels. *Journal of the Acoustical Society of America, 32*, 693-703.

Plichta, B. (2003). *Hearing faces. Effects of ethnicity on speech perception*. Retrieved Jan. 1, 2004, from http://www.bartus.org

Preacher, K. J. (2003). *Calculation for the chi-square test*. Retrieved Dec. 5, 2003, from http://www.unc.edu/~preacher/chisq/chisq.htm

Preston, D. R. (Ed.). (1999). *Handbook of perceptual dialectology* (Vol. 1). Philadelphia: John Benjamins Publishing Company.

Purnell, T., Idsardi, W., & Baugh, J. (1999). Perceptual and phonetic experiments on American English dialect identification. *Journal of language and social psychology, 18*, 10-30.

Racial Profiling. (2005). Retrieved Feb. 15, 2005, from http://en.wikipedia.org/wiki/Racial_profiling

Rickford, J. R. (1999). *African American Vernacular English*. Malden, MA: Blackwell.

Seuss, D. (1961). *The Sneetches and other stories*. New York: Random House.

Strand, E. A. (1999). Uncovering the role of gender stereotypes in speech perception. *Journal of language and social psychology, 18*, 86-100.

Thomas, E. R. (2001). *An acoustic analysis of vowel variation in New World English. PADS 85*. Durham, NC: Duke University Press.

Thomas, E. R. (2002). Sociophonetic applications of speech perception experiments. *American speech, 77*, 115-147.

Thomas, E. R., & Bailey, G. (1998). Parallels between vowel subsystems of African American Vernacular English and Caribbean Anglophone Creoles. *Journal of pidgin and creole language, 13*, 267-296.

Thomas, E. R., Carpenter, J., & Lass, N. (2004). *A comparison of phonetic cues used for ethnic identification.* Paper presented at NWAV 33, Ann Arbor.

Thomas, E. R., & Reaser, J. (2004a). *An experiment on cues used for identification of voices as African American or European.* Paper presented at LAVIS III, Tuscaloosa.

Thomas, E. R., & Reaser, J. (2004b). Delimiting perceptual cues used for the ethnic labeling of African American and European American voices. *Journal of Sociolinguistics, 8*, 54-86.

Torbert, B. (2004). *Salience measurements of southern vowels.* Paper presented at LAVIS III, Tuscaloosa.

Traunmüller, H. (1990). Analytical expressions for the tonotopic sensory scale. *Journal of the Acoustical Society of America, 88*, 97-100.

Tucker, R., & Lambert, W. (1969). White and Negro listeners' reactions to various American-English dialects. *Social forces, 47, 463-468*.

Walton, J. H., & Orlikoff, R. F. (1994). Speaker race identification from acoustic cues in the vocal signal. *Journal of speech and hearing research, 37*, 738-745.

Wise, T. (2001). *Why whites think blacks have no problems*. Retrieved Feb. 1, 2005, from http://www.alternet.org/story/11192

Wolfram, W. (2003). *Linguistic subordination and ethnolinguistic identity: the construction of African American English*. Retrieved Feb. 1, 2005, from http://www2.chass.ncsu.edu/cies/WolframPaper.htm

Wolfram, W., & Thomas, E. R. (2002). *The development of African American English*. Malden, MA: Blackwell.

Appendices

Appendix A: Response sheet for Chapter 3 experiment

Thanks so much for participating in this experiment!!

Part I
You will hear a series of recorded words. Your task for each word is to (a) try to guess which of the provided words was said, and (b) try to guess the ethnicity of the speaker. Many of the words will be repeated.

1) sad said Afr. Am. Euro. Am

2) knack neck Afr. Am. Euro. Am

3) sad said Afr. Am Euro. Am

4) pat pet Afr. Am Euro. Am

5) bad bed Afr. Am Euro. Am

6) bat bet Afr. Am Euro. Am

7) gas guess Afr. Am Euro. Am

8) bat bet Afr. Am Euro. Am

9) bad bed Afr. Am Euro. Am

10) tack tech Afr. Am Euro. Am

11) bad bed Afr. Am Euro. Am

12) gas guess Afr. Am Euro. Am

13) knack neck Afr. Am Euro. Am

14) sad said Afr. Am Euro. Am

15) pat pet Afr. Am Euro. Am

16) knack neck Afr. Am Euro. Am

17) bad bed Afr. Am Euro. Am

18) tack tech Afr. Am Euro. Am

19) knack neck Afr. Am Euro. Am

20) sad said Afr. Am Euro. Am

Part II
In this section, you will hear another series of words. These words may be difficult to understand – just do the best you can. Your task in this section is solely to guess the ethnicity of the speaker. In each case the recorded word has been provided on your answer sheet.

1) Cat

Afr. Am Euro. Am.

2) That

Afr. Am Euro. Am.

3) Have

Afr. Am Euro. Am.

4) Have

Afr. Am Euro. Am.

5) Pad

Afr. Am Euro. Am.

6) Cat

Afr. Am Euro. Am.

7) Pass

Afr. Am Euro. Am.

8) Hat

Afr. Am Euro. Am.

9) Pass

Afr. Am Euro. Am.

10) Hat

Afr. Am Euro. Am.

11) Fast

Afr. Am Euro. Am.

12) Pad Afr. Am Euro. Am. **13) Back** Afr. Am Euro. Am. **14) Back** Afr. Am Euro. Am. **15) Fast** Afr. Am Euro. Am. **16) That** Afr. Am Euro. Am.	

Demographic information

Please provide the following demographic information for yourself

Age_____

Ethnicit(ies)_____

Sex_____

Hometown city, state (where you grew up)

_____

Parents' level of education (circle one each)

Mother	**Father**
None	*None*
Elementary School	*Elementary School*
Junior high school	*Junior high school*
High school	*High school*
Some college	*Some college*
College graduate	*College graduate*
Post-graduate	*Post-graduate*

Please check if applicable:

____ I have already completed this experiment in another class.

Appendix B: Response sheet for Chapter 4 experiment

In this experiment, you will hear a series of words. These words have been synthetically modified, and may be difficult to understand – just do the best you can. Your task is to identify the ethnicity of the speaker. Each word will be repeated three times, and you will have approximately 5 seconds to circle your response. In each case the recorded word has been provided on your answer sheet. **Thanks so much for your help!!**

1) Feathers

Afr. Am Euro. Am.

2) Eggs

Afr. Am Euro. Am.

3) Ted's

Afr. Am Euro. Am.

4) Steps

Afr. Am Euro. Am.

5) Next

Afr. Am Euro. Am.

6) Becky

Afr. Am Euro. Am.

7) Bed

Afr. Am Euro. Am.

8) Steps

Afr. Am Euro. Am.

9) Said

Afr. Am Euro. Am.

10) Deb's

Afr. Am Euro. Am.

11) Desk

Afr. Am Euro. Am.

12) Bed

Afr. Am Euro. Am.

13) Said

Afr. Am Euro. Am.

14) Desk

Afr. Am Euro. Am.

15) Becky

Afr. Am Euro. Am.

16) Ted's

Afr. Am Euro. Am.

17) Deb's

Afr. Am Euro. Am.

18) Next

Afr. Am Euro. Am.

Demographic information

Please provide the following demographic information for yourself

Age_____

Ethnicit(ies)_____

Sex_____

Hometown city, state (where you grew up)

_____

Parents' level of education (circle one each)

Mother	**Father**
None	*None*
Elementary School	*Elementary School*
Junior high school	*Junior high school*
High school	*High school*
Some college	*Some college*
College graduate	*College graduate*
Post-graduate	*Post-graduate*

Please check if applicable:

__ I have already completed this experiment in another class.

__ I have been diagnosed with a hearing impairment

Appendix C. Praat script for segmenting long recordings

```
form Spice N Dice
        comment Enter your desired clip length in seconds.
        positive clip_length
endform

speaker$ = selected$ ("LongSound")

length = Get total duration



clip = 0
time = 0

while time < length
        clip = clip+1
        Extract part... time time+clip_length+5 1
        time = time+clip_length
        Rename... 'speaker$'clip'clip'
        Write to WAV file... splicendiceoutput/'speaker$'clip'clip'.wav
        select LongSound 'speaker$'
Endwhile
```

Appendix D: Praat script for recording formant data

```
form Script for Libby, Melissa and Drew's Fantastic Phonetics Project
	comment By this point, you should have already carefully selected your vowel.
	comment You also need to be sure you have the formant tracker on.
	comment Data will be appended to a file called "Data.txt" in the directory where this script is stored.
	comment You must also be sure that you have the current Sound object selected in the Object Window.
	sentence speaker_ID Donna Eakes
	sentence speaker_eth W
	sentence vowel E
	sentence the_word
	real formant_setting 4
	boolean showinfo 1
endform

begin = Get begin of selection
end = Get end of selection
dur = (end-begin)
mid = begin+(dur/2)
msdur = dur*1000

filename$ = selected$ ("Sound")

Move cursor to... mid
f1 = Get first formant
f2 = Get second formant
f3 = Get third formant

if showinfo
	clearinfo
	printline Word:'tab$' 'the_word$'
	printline F1:'tab$' 'f1:2'
	printline F2:'tab$' 'f2:2'
	printline F3:'tab$' 'f3:2'
endif

fileappend Data.txt
'speaker_ID$''tab$''speaker_eth$''tab$''vowel$''tab$''f1:2''tab$''f2:2''tab$''f3:2''tab$''msdur:0''tab$''formant_setting''tab$''the_wo
rd$''tab$''begin''tab$''mid''tab$''end''tab$''filename$'.wav'newline$'

Select... begin end
```