Brain responses to contrastive and noncontrastive morphosyntactic structures in African American English and Mainstream American English: ERP evidence for the neural indices of dialect

Felicidad M. García

Submitted in partial fulfillment of the
Requirements for the degree of
Doctor of Philosophy
under the executive committee
of the Graduate School of Arts and Sciences

COLUMBIA UNIVERSITY
2017

ABSTRACT

Brain responses to contrastive and noncontrastive morphosyntactic structures in African American English and Mainstream American English: ERP evidence for the neural indices of dialect

Felicidad M. García

Recent research has shown that distinct event-related potential (ERP) signatures are associated with switching between languages compared to switching between dialects or registers (e.g., Khamis-Dakwar & Froud, 2007; Moreno, Federmeier & Kutas, 2002). The current investigation builds on these findings to examine whether contrastive and non-contrastive morphosyntactic features in English elicit differing neural responses in bidialectal speakers of African American English (AAE) and Mainstream American English (MAE), compared to monodialectal speakers of MAE. Event-related potentials (ERPs) and behavioral responses (response types and reaction time) to grammaticality judgments targeting a contrasting morphosyntactic feature between MAE and AAE are presented as evidence of dual-language representation in bidialectal speakers. Results from 30 participants (15 monodialectal; 15 bidialectal) support the notion that bidialectal populations demonstrate distinct neurophysiological profiles from monolingual groups as indicated by a significantly greater P600 amplitude from 500ms – 800ms time window in the monodialectal group, when listening to sentences containing contrasting features. Such evidence can support the development of linguistically informed educational curriculums and clinical approaches from speech-language pathologists, by elucidating the differing underlying processes of language between monodialectal and bidialectal speakers of American English.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGMENTS

Somehow, life has taken me down a path toward completing this impossible thing and I have many people to thank for seeing me through it.

First and foremost, thank you, Dr. Karen Froud, for your unwavering support of me and this work these past 7 years. I feel so fortunate to have learned from you as a clinical supervisor, a research mentor, and a friend. Thank you for knowing I could accomplish this well before I did, and for offering a welcome space for graduate students to pursue socially conscious research questions.

To my lab mates at the Neurocognition of Language Lab, thank you for answering my frantic calls for help, especially Dr. Trey Avery and Dr. Guannen Shen, without whom this work would have taken me many more years. I also want to give *un abrazo bien fuerte* to Maria LaMadrid, for her support, her open door, and for inspiring me to live creatively in all parts of my life.

A very special thanks goes out to my committee, which is made up of people I admire and feel truly lucky to know: Dr. Reem Khamis-Dakwar, Dr. Lisa Edmonds, Dr. Jamie Reilly and Dr. Carol Scheffner-Hammer. I owe a particular debt of gratitude to Reem, who was the first believer in this study and who paved the way for this research using EEG methodology in her own research with Arabic language varieties.

I couldn't possibly thank enough all those people in my life who have nothing to do with this field and who tolerated me anyway. To all the participants who sat through my experiments – many of whom were dear friends – I appreciate you so much for helping make this project happen. To my sister from another mister, Monica Orta, thank you for hearing out all my angst and for always guiding me toward answers. A giant, life-creating thank you goes to my *mamí*, Haydee Gonzalez, who took me to libraries more than playgrounds as a child, and who always nurtured my sense of wonder. Finally, I want to thank my wife, Dese'Rae Stage, for being a person who is also moved by unasked questions. Thank you for helping me find the room in our lives where this work would fit, for disentangling the endless details with me, and for making me laugh-through-tears as it all came together.

1. INTRODUCTION

Within the study of language is the study of dialect. Dialects allow for multiple varieties of a language to exist within a given system, and can vary in how similar they appear to the more mainstream—or *standard*—language. As an element of culture, languages represent communities. Mainstream American English (MAE) is the variety of English valued and used by the dominant culture in the United States, as represented by the majority of media, educational materials and native Euro-American English speakers. African American English (AAE) is a variety of American English most often spoken by or among African Americans and bidialectal urban working class communities, with written forms used to reflect the experiences of its speakers in musical and literary works (Wolfram & Thomas, 2008; Kortman, Schneider, Burridge, Mesthrie, & Upton, 2004; Young, Barret, Young-Rivera & Lovejoy, 2013).

The use of minority dialects in the US has long been a topic of debate, particularly in educational settings, where significant academic achievement gaps have been observed between White and Black students, across subjects, even when controlling for SES and parental educational background (Jencks & Phillips, 2011). It has been proposed that linguistic mismatches between home language and the language of reading instruction can contribute to difficulties with the learning process and low reading success for students who speak AAE at home, if curriculums do not take these differences into account (e.g., Labov, 2003). Reading performance, as a basic skill for educational development, impacts academic ability across subjects, making it of particular interest to educators looking for ways to narrow the achievement gap.

Many studies of reading development have attempted to investigate whether dialect-shifting (from the English spoken at home to the English variety taught at school) consistently impacts reading performance on standardized tests for AAE-speaking children (Craig, Zhang, Hensel, & Quinn, 2009; Charity, Scarborough, & Griffin, 2004; Connor & Craig, 2006; Craig & Washington, 2004). Large-scale normative studies have demonstrated that there are at least 40 distinct feature differences between AAE and MAE in children, prompting many school systems to adopt curriculums that incorporate explicit training in codeswitching for educators and students, in order to support reading and writing instruction (Craig, Thompson, Washington, & Potter, 2003; Hinton & Pollock, 2000; Seymour & Ralabate, 1985; Stockman, 1996; Washington & Craig, 1994, 2002). If dialects incorporate aspects of language structure that act as separate linguistic systems, then it would stand to reason that children receiving explicit instruction in bidialectal codeswitching programs (i.e., English as a Second Dialect or Dialect Awareness classrooms – discussed in more depth in chapter 2) should show the same positive effects in reading and writing performance as those consistently seen with children in bilingual English language programs (e.g., English as a Second Language classrooms). However, some research has indicated that incorporation of codeswitching education into classrooms only marginally increased students' reading scores, and dramatically reduced scores on measures of students' self-confidence (Edwards, McMillion & Turner, 2010; Cassar, 2008). The reasons for such deleterious changes are unclear.

Most studies of dialect have been performed using behavioral assessments and observations of oral narratives, elicited in diverse environmental conditions, aimed at cataloguing contrastive features so that educators, speech-language pathologists, researchers and students can better understand the differences between the two most-spoken dialects in the United States. However, no current studies directly investigate questions regarding the neurophysiological nature of bidialectal language processing in AAE-MAE speakers. The current study sought to increase understanding of dialect processing in an interdisciplinary manner, via the application of objective, neurophysiological measures, leading to the analysis of brain responses to sentences containing morphosyntactic features present in AAE and MAE, respectively.

Using electroencephalographic (EEG) methods, this investigation provides some evidence for how dialectal syntax differences between AAE and MAE are processed in native speakers of AAE and MAE through the measurement of both behavioral accuracy and response time (on a grammaticality judgment task) alongside the recording of neurophysiological responses to error detection in the language. EEG studies of this type have so far been more frequently used in the research of bilingualism than dialects, with only one study on phonological dialect difference in U.S. Englishes to date (Conrey, Potts & Niedzielski, 2005). By broadening the neurolinguistic research to include the processing of dialect variation, the fields of education, psychology, linguistics and speech-language pathology can begin to make comparisons between multilingual and multidialectal groups, and use their findings to work toward improved educational and clinical service provision for all students, potentially narrowing the achievement gap between racial/ethnic groups of students.

The dissertation presented here is organized as follows: Chapter 2 provides an overview of MAE and Non-mainstream American English (NMAEs), with a particular focus on AAE. To start, the history and features of AAE are reviewed, with commentary provided on the many social views surrounding its use, including common misconceptions. The second part of chapter 2 focuses on current evidence of educational outcomes for bidialectal students and discusses the implementation and controversy surrounding dialect awareness programs in school curriculums. The end of chapter 2 provides an overview of EEG methods, specifically event-related potentials (ERP), for the study of language differences. Several language-related ERPs are reviewed, and a defense is provided for the investigation of the present progressive –s marker on the verb as a target in this first exploration of bidialectal morphosyntax processing of AAE-MAE bidialectals as compared to MAE monodialectals. Chapter 3 presents the research questions, hypotheses and rationales for the current study. Chapter 4 describes the study design in detail, including participant requirements, stimulus creation and presentation, experimental procedure, and proposed data analyses. Chapter 5 presents the study results. Chapter 6 offers an overview and discussion of the findings, as well as the study's observed limitations and delimitations, with suggested future directions.

2. BACKGROUND

In this chapter, background will be provided on the diverse disciplines whose research intersects in this dissertation study. This includes dialect research – specifically the history and behavioral study of what is being referred to here as African American English (AAE) – and a review of how evoked response potentials (ERP) have been used to study bilingual and bidialectal language processing to date. Since this is the first study to examine morphosyntactic processing in bidialectal speakers using ERP measures, this combined background of the two disciplines involved in language research will lay a foundation for the current experiment. By comparing the processing of AAE and Mainstream American English (MAE) using brain imaging for the first time, rather than the traditional, behavioral measures seen in dialect research, new evidence of bidialectal English processing is presented. To this end, first a background on dialect in general is provided, preceding a review of African American English, leading to a background of electroencephalographic (EEG) methods, including a description of ERPs and some of the components that are associated with language processing. Special attention in the description of AAE will be paid to the grammatical subject agreement –s marker. In the description of ERPs, particular focus will be given to the P600 component. This is because both the third person singular –s marker and the P600 are targets of this dissertation study. Reasoning for their selection will be given, with specific questions of the research and rationales to be provided in Chapter 3. Methodology and detailed procedures for eliciting target responses to auditory language stimuli to be described in Chapter 4.

2.1 Dialects

A dialect is a variety of a spoken language, which holds particular features of grammaticality, lexicality and phonology that may set it apart from the mainstream or standard language, depending on context (Strevens, 1981). Globally, languages are defined as *autonomous* in their ability to contain other varieties within them, whereas this is not true for dialects, which are accordingly defined as *heteronomous* (Melchers & Shaw, 2003). This is because the pre-requisites for either are unclear, as there is no minimum feature requirement for classification as a dialect (Wolfram, 1991); a dialect can be characterized by a difference in accented speech (e.g., phonology), vocabulary use (e.g., semantics), and/or grammar use (e.g., morphology, syntax). In spite of popular and scholarly debate on these topics, there are no official parameters outlining the number of necessary features required of a dialect and no standards exist for reclassifying a dialect as a *language* (Morgan, 1994; Wolfram, 1998).

What are known as dialect differences vary within populations on the basis of regional, ethnic or social characteristics of their speakers. Language differences that vary on the basis of pronunciation alone, while "staying within certain grammatical and lexical bounds", are more commonly considered an *accent* (Gramley & Pätzold, 2004, p. 7). Sometimes the distinction between dialect and accent is also unclear or overlapping, as might be seen when discussing Boston English speaker's production of father (/faðə/) and the New York City English speaker's production of father (/fɒːðə/) (Trawick-Smith, 2011). By and large, these are considered accents, despite the existence of morphosyntactic and semantic variations between the two varieties. This study specifically explores the morphosyntactic contrasts between dialects.

Another common type of linguistic modification is known as a *diatype* or *register* change. This refers to the situational variation of language occurring in contexts of varying formality, topic, modality, and personal factors such as age and gender differences between conversational partners (Gramley & Pätzold, 2004). Language registers are most often characterized by changes in vocabulary as part of a lexical shift to be more or less casual. For example, a speaker might make use of lexical differentiation (i.e., spoken word choice) to elevate the status of an object or action, such as might be heard when being offered a 'beverage' at a more formal event, and a 'drink' at a casual event (Gregory, 1967). The separation of a *subdialect* from a *register* is as contested as that of *dialect* from *language*. Overall, the use of registers specifies peer groups defined by age, interest communities, gender, and other contextualized factors; however, many of these same parameters also apply to dialects, not only languages.

The inconsistent classification of registers, dialects and languages is most apparent when we consider languages outside of our native language, where sociocultural schemas play less of a role in our metalinguistic concepts. From the position of this study in American English, an example can be taken from Mandarin, Cantonese and Wu, which are all considered major Chinese *dialects*, despite the stark differences between these varieties across linguistic parameters. Yet, so different are these 'dialects' from one another that they are not mutually intelligible between monolingual speakers of Chinese, but are united by a common civilization and writing system (Kachru, 2006). Conversely, Portuguese, Italian, and Spanish speakers have greater linguistic overlap as speakers of Romance languages (derived from Latin), but are considered distinct *languages* due to cultural and regional demarcations. If we shift our focus back to English with this in mind, we can then observe that this categorical language assignment based on sociopolitical factors over linguistic ones is evident across several mutually-unintelligible English 'dialects,' such as Patois (a Jamaican dialect of

English), Cockney (a working-class British English dialect originating in London), and Gullah (i.e., Geechees; a U.S. English creole spoken by African Americans in Southeast coastal regions). These language varieties are debatably all considered dialects under a singular English language, despite the fact that their features are so different that monodialectal speakers of one version would likely find speakers of another version unintelligible in conversational speech. Even with this unity, powerful groups have declared themselves linguistically independent, as American English (AE) and Australian English (AuE) did long ago with the creation of separate dictionaries and grammatical descriptions (Mencken, 1936; Collins & Blair, 1989). Given the spread of English globally, some have looked to unify with an International English or World English standard (Jenkins, 2000; Brutt-Griffler, 2002) while others have sought to standardize individual varieties worldwide (Melchers & Shaw, 2003; Gramley & Pätzold, 2004).

In many communities, there exists a *standard-with-dialects* situation, while other communities maintain a *diglossia* wherein two language varieties co-exist in functionally and linguistically complementary distribution (e.g., Ferguson, 1959, though see Marçais, 1930-31 for prior mention of *diglossie*). In some diglossic language communities, both language varieties have been fully developed for a century or more, demonstrating a stable dichotomy (e.g., Arabic, Greek), while others occurred more recently as the result of language isolation (e.g., Swiss German) or the creolization of a pidgin (e.g., Haitian Creole) (Ferguson, 1959; Kaye, 1994; Winford, 1985; Rickford, 1979).

While diglossia remains a marginal area of linguistic study, Arabic speakers have been frequently examined as a classic and modern example of *diglossia* (for a review, see Khamis Dakwar & Makhoul, 2014). In Arabic-speaking communities both spoken and literary dialects exist; the spoken dialect (which varies regionally) is acquired naturally and considered by researchers to be the mother tongue, while the literary dialect is later introduced upon entering school (e.g., Saiegh-Haddad & Henkin-Roitfarb, 2014). The spoken variety of Arabic is considered "colloquial", and is the language spoken in the home, the market, with family, colleagues and friends in casual settings (e.g., Rosenhouse, 1997, 2008; Holes, 2004). The literary or standard variety is the Arabic dialect to be spoken and written in more formal settings, including classrooms and professional venues, and has a spoken and written form, which is explicitly taught in schools.

Diglossic language situations demonstrate the sociolinguistic separation of two language systems into what are sometimes referred to as *high* and *low* varieties, due to the perception that the standard variety is often considered more "pure" or "sacred" than the spoken variety (e.g., Haeri, 2003; Winford, 1985). Linguistic features of a diglossic language situation, in Ferguson's original (1959) classification, include a genetic relationship between the varieties, but distinctions that are stable in their own right, including distinguishing lexical, grammatical and phonological features (Winford, 1985). Sociocultural factors of a diglossic language include a specialization of functions, where the standard variety holds higher prestige and is therefore used in the classic literature; the standard variety is typically formally taught in schools since children tend to acquire the colloquial variety at home (Holes, 2004; Winford, 1985; Ferguson, 1959). In this study, a relationship between African American English and Mainstream American English is acknowledged as being more similar to a diglossic situation than a standard-with-dialects situation, and this too, has been noted in diglossia literature, and will be discussed at more length later in this chapter (Labov, 2003; Makhoul, Copti-Mshael & Khamis Dakwar, 2015; Young, et al., 2014). Though Winford (1985) has claimed that the 'structural gap' between AAE and MAE might not be sufficiently broad to classify the relationship between them as a diglossia, he also states that this classification poses the obvious difficulty of comparing dialects across situations (cf. also Wexler, 1971). These questions regarding the maximum and minimum limits for defining diglossic variation are the same as those posed regarding languages and dialects.

Worth noting in populations where the spoken language form has features that differ from the written language is that public awareness of the differences between varieties is often diminished by their not being conceptualized by lay people as two distinct systems (Ferguson, 1959; Makhoul, et al., 2015; Adger, Wolfram & Christian, 2007). This conceptualization of a speaker's own language varieties as distinct systems, and the ability to access and manipulate these systems, is called *dialect awareness* (Bialystok & Ryan, 1985). Dialect awareness represents a metalinguistic ability to consider the subsystems (e.g., syntax, phonology, semantics, etc.) within a singular language and how they are defined between groups (e.g., region, race, ethnicity, class) as characterizing a different variety. In some diglossic language communities, the importance of the standard variety is felt so strongly that a kind of dissociation from the colloquial variety occurs that keeps its speakers from even considering it as a separate language variety; many people in this situation might deny the existence of two varieties (e.g., Eviatar & Ibrahim, 2000; Ferguson, 1959). Dialect awareness also need not be a conscious delineation between language varieties, for it can include automatic changes in language, based on audience or conversational partner, as appropriate. Conversational changes from one language variety to another, which depend on context and listener, are labeled codeswitches.

Codeswitching or codemixing is defined as the use of two or more language varieties, whether distinct languages or dialects of the same language, in the same speech event (Woolard, 2004). Research with Arabic and AAE has demonstrated that, by third grade, typically developing children in diglossic language situations where there is an oral-literacy language mismatch demonstrate explicit knowledge of their two language systems and codeswitch between varieties (Makhoul, Copti-Mshael & Khamis Dakwar, 2015; Craig, et al., 2003; Thompson, Craig & Washington, 2004). Studies of English-Spanish bilingual communities with simultaneous acquisition in the US have shown codemixing at the sound, word or phrase level to be a common event until preschool, by which time less than 2% of utterances are mixed (Paradis, Nicoladis, & Genesee, 2000). In this third and final stage of simultaneous bilingual language acquisition, lexical and syntactic structures are correctly produced in each language, with some transference expected. Codeswitching between languages (not diglossic) occurs more often on nouns than on other parts of speech (Pfaff, 1979). For example, "Where are my *chancletas* [sandals]?" is an example of an intrasentential codeswitch, and the direction is from English to Spanish on the use of the noun.

Two leading grammatical models of codeswitching exist which attempt to explain the various constraints on what can and cannot be embedded in a given language variety when switching from one language variety to another (Muysken, 1995). In the dominant theory of codeswitching, Poplack (1984) presents the concept of *equivalence constraints,* which states that codeswitching between language varieties can only occur at points where the grammatical structures of both are obeyed (e.g., a Spanish-English bilingual would not say *"el carro red"* or *"the rojo car"* because of violations occurring in at least one language variety in each phrase). A different approach is espoused within the Matrix Language Frame model (Scotton, 1993), which introduces the concept of a Matrix Language containing an embedded language, where the embedded language represents the less dominant language variety. In the example question, "Where are my *chancletas?*" the matrix language would be English, indicating dominance in English, with the embedding of the Spanish word, *chancleta*, as the codeswitched noun preferred for a defining quality not present in the dominant language's translated equivalent (a casual-dress sandal). Overall, codeswitching models are most often discussed with reference to multilingual rather than multidialectal speakers (Milroy & Muysken, 1995). In many ways this may be due to the complicated nature of dialect use and to the confounds instantiated in individuals with varying levels of dialect awareness, as previously described. Together, these factors limit the ability of researchers to gain insights into the representation and processing of language varieties that the speaker may be variably conscious of using in functionally different ways. The complexity of dialect study holds across nonmainstream American English (NMAE) dialects, further described in the following section. In order to discuss NMAE dialect research, the following section will provide context for how standard American English is defined, including its historical background as a field of study.

2.2 American English

The concept of a 'standard' has long been an issue of debate. Beginning in the late 19^{th} and early 20^{th} centuries, linguists attempted to determine whether literary (i.e., written) usage of American English should be held as the spoken standard, or whether the richness of written language was driven by the vitality of spoken language. In this context, holding written language as the standard variety for spoken usage would at that time have implied a "wrongness" in the spoken American English of the many illiterate monolingual American speakers who did not have access to education, including speakers of various regional dialects. Scholar George Phillip Krapp was one of the first to ask, "who are the cultivated and refined speakers whom we are willing to regard as affording the model or laws of the correct or standard speech?" (*Modern English*, 1909, pp. 159-160 as cited by Finegan, 1980, p. 83). Grammarian scholars from the mid-18^{th} century defended the idea that languages should have absolute rules, which should not be altered by the evolution of spoken languages. Those who opposed this view did so on the grounds that the effort to keep language features fixed in place (i.e., a standard) was a historically futile one; Thomas Lounsbury, an early dissenter of prescriptive grammar, wrote that "in order to have a language fixed, it is first necessary that those who speak it should become dead…" (*The Standard of Usage in English*, 1908, p. 71, as cited by Finegan, 1980, p.77). This debate on the fundamental nature of language as fixed or fluid, especially as it intersects across groups with and without power, spurred an increased interest in defining the types of English spoken in the United States, increasing our knowledge and awareness of dialects as having their own structured forms, phonologies and lexicons.

2.2.1 Mainstream American English and Non-mainstream American English.

American English is an umbrella term for a dialect that incorporates many English language varieties (i.e., subdialects) in the United States. Within this larger concept is Mainstream American English (MAE), also known as General American English or Standard American English (Wolfram & Schilling, 2015). MAE is considered the closest to a 'standard' variety of English in the US, whose grammatical features are taught in schools, and broadly used in written and spoken English for media (e.g., newspapers, textbooks, television, radio and literature). In these educational and professional domains, grammatical correctness is therefore often judged to the standard of MAE.

Non-mainstream American English (NMAE) refers to a category of dialects, American Englishes that differ from the standard. NMAE dialects - like all dialects - are characterized and often defined by the regional, ethnic and / or social class of its speakers. One of the most common NMAEs defined by region, for example, is Southern American English, spoken by a broad group of residents across the Southeast and middle Southern United States. By contrast, Appalachian English and Ozark English are more specific regional subdialects spoken by residents of the isolated mountainous areas after which they are named (Wolfram & Schilling, 2015). As a minority dialect not taught in school, an NMAE is more often spoken than written and is more often heard in domains outside professional and educational settings, such as in the home and/or community areas of its speakers (e.g., stores, parks, streets, etc.; Wolfram & Thomas, 2008).

Classification of dialects can be made according to region, ethnicity or social class, with differences in semantics, morphology, phonology, or syntax; however, SES, age, gender, and sampling context are important factors to consider when investigating dialect use (Agerton & Moran, 1995; Lucas & Borders, 1994; Rickford & McNair-Knox, 1999; Washington, Craig, & Kushmal, 1998). For example, Chicano English (CE) and African American English (AAE) are considered ethnically classified dialects, defined by their historical influence and originating from the language group of a minority ethnicity or race in the U.S. (Wolfram & Estes, 2005; Bernthal & Bankson, 1993); but use of forms can differ across the lifespan, and in different American communities, depending on the speaker and interlocutors. In the United Kingdom, English dialects defined by social class are more prevalent, but in the United States, Boston English (i.e., the 'Townie' accent) and the Boston Brahmin dialect are among the few American English dialects currently defined by a class group alone (Wolfram & Schilling-Estes, 1998). All of the aforementioned dialects are considered NMAEs, and have features that differentiate them from MAE. However, these delineations should be tempered by the understanding that language is a dynamic system, constantly evolving, adding and merging new varieties. This understanding is the premise by which this study has chosen the terminology 'mainstream' and 'non-mainstream' to describe language varieties, which are considered relatively closer to and further from the *standard*, respectively.

This dissertation study compares the language processes and responses of African

American English bidialectal speakers with those of Mainstream American English monodialectal speakers. What follows is a brief history of African American English as a language variety in sociolinguistic and educational contexts, leading to an explanation of how the neurophysiological research conducted in this study contributes to our understanding of dialect differences.

2.2.2 African American English.

African American English (AAE) is an ethnically defined NMAE dialect, which differs from MAE along semantic, morphological, syntactic, and phonological parameters. Although African Americans represent the majority of AAE speakers, not all African Americans speak AAE, and other racial and ethnic populations also use common features of AAE in their speech (Wolfram, 1974). The use of 'vernacular' (as in African American Vernacular English) to describe this variety is purposefully omitted in this study, because of the problematic implication that a vernacular language variety exists only for informal use and in opposition to a 'standard' variety spoken by White Americans as a matter of course (Morgan, 1994). Various sources estimate that between 60 and 99% of African Americans (AA) use at least some features of AAE in their spoken communication (Spears, 1987; Dillard, 1972; Ulatowska & Olness 2001; Smitherman, 1977). AAE also cannot be viewed as a unitary dialect because, in those populations where AAE is spoken, several of its features can also be influenced by overlapping regional dialects (e.g., Southern American English, Appalachian English, Louisiana Bayou English, etc.), and usage can vary based on age and socioeconomic class (Johnson, 2000).

Table 1 delineates morphological and syntactic features present in AAE, along with grammatical descriptions and usage examples, which have been adapted from large-scale studies on AAE language development and linguistic texts on typical child and adult productions (Craig, et al., 2003; O'Grady, William, Archibald, Aronoff, & Rees-Miller, 2001).

Table 1: *Representative List of AAE Contrastive Morphology & Syntax Features*

	Feature	Grammatical Use	Usage Examples
Number	**Unmarked plurals**	Variable inclusion of plural marker –s. Non-obligatory for numbers/pronouns; more often absent with nouns of measure	"two sock_/dog_/kiss_" "ghost_ are boys" "I got five cent_"
	Nonstandard subject-verb agreement	SV differ in either number or person; can include marking verbs with -s following irregular	"He tries to *kills* them" "He *sit*_ right there everyday" "There was five of 'em"
	Indefinite or absent article	"a" regardless of vowel contexts; *the* is nonobligatory	"Brandon had to play for *a* hour, didn't he?" "This cake is __ best present of all"
	Regularization of irregular plurals	marking irregular plurals with -s suffix	"The *mens* are standin' up"
Verb-Modifier	**Zero *to***	infinitive marker "to" is deleted	"That man right there getting ready __ slip on his one foot"
	Preterite *had*	*had* used before simple past verbs	"He flew with a strong stick in his claws while the turtle *had* held the stick fast in her mouth"
	Absent modal auxiliary	*Will*, *can*, *do*, and *have* are variably excluded when expected as modal auxiliaries	"he might __ been in the car"
	Zero preposition	Prepositions are variably excluded	"she sits and looks __ birds"
	Double modal/ auxiliary/ copula	two modal auxiliary forms used for a single clause	"*I'm is* the last one ridin on"
Aspect & Tense	**Zero past tense**	-ed not always used to mark past in regular forms	"and this car *crash*__"
	Present tense for regular past	Present tense used for irregular past	"and then them *fall*"
	Different irregular verb use	Past tense form as past participle and use of past participle form as past tense	"I had *went* there Monday"; "He *seen* 'em before"
	Stressed *been;* Remote *BIN*	used to mark longstanding action initiated in the remote past	"it *been* hurting me" [MAE translation: *it hurt me a long time ago and still does*]
	Invariant *be*	infinitive "be" with varied -s for habitual action OR to state a rule	"sometime_ she *be* here" "and they *be* strict about it"
	Completive *done*	*Done* is used to emphasize a recently completed action	"He *done* set the fire"
	Unmarked Present progressive tense verbs	Unmarked agreement between pronouns and present progressive tense verbs	"she hit_/run_/dodge_"
	Unmarked	copula and auxiliary form *to be*	"He_ running/she_

	copulas	absent	running"; "But she always comes down when it __ time to eat" "Then you__ have to wear the brown ones instead"
	Existential *it*	*It* is used in place of *there* to indicate the existence of a referent without changing meaning	"I think *it's* a girl yelling"
Negation	***Ain't***	*ain't* as a negative auxiliary seen for *isn't, haven't* and *don't*	"Why she *ain't* comin?" "This *ain't* no Mickey Mouse"
	Multiple negation	2 or more negative markers / negative polarity items in a single clause without double negation interpretation	"I *don't got* *no* brothers" "He *don't know* *nothing*" "*Can't* *nobody* beat him"
Pronouns	**Appositive pronoun / left dislocation**	both a pronoun and noun, or two pronouns reference the same person or object	"The *teacher* *she's* goin' up here" "And the other *people* *they* wasn't"
	Undifferentiated pronoun case	nominative/objective/demonstrative occur interchangeably	*"Him* did and him"; "H*er* fell"
	Regularized reflexive / Pronominal differences	reflexive pronouns: *himself* as "hisself," *themselves as* "theyself"	"He stands by *hisself"; "*He hurt *hisself"*
	-s marked possessive pronoun	Regularization of possessive pronouns	"It's *mines"*
	Zero possessive	Possessive coded by word order, with no -s maker OR nominative/objective case is used rather than possessive	"He hit the *man_* car" "Kids just goin' walk to *they* school"
	Relative pronoun differences	use of "what" for *that*	"That's the one *what* I was tellin' you 'bout"

Note. This is not intended to be a comprehensive list of the features of AAE. All features and examples in this list were taken from Craig, Thompson, Washington & Potter, 2003, Thompson, Craig & Washington, 2004, and Wyatt, 1995; linguistic descriptions were altered in some cases to be more consistent with current terminology and understanding.
Red - indicates a feature that was hypothesized but never found in the Craig, Thompson, Washington & Potter, 2003 study data.
Yellow - indicates a feature that is sometimes categorized together as the "-*s* markers," notable for their omission across grammatical contexts, one of which is the target of this study.

The use of AAE intersects with issues of race, class and gender, yielding lively debate across a range of topics under study today, such as the development of American youth, the impact of hip-hop music, and the language of school instruction. Misconceptions about AAE are common outside the linguistics community, where discussion is largely focused on the sociolinguistic status of this and other dialects, and on the delineation of specific features. The following sections are provided to draw lines between the various domains of use and time points in the development of AAE, both as a scholarly topic and as a contemporary issue in linguistics, social reform, education, speech-language pathology and neuroscience.

2.3 History of AAE

2.3.1 Origin Theories of AAE.

Leading theories on AAE are grounded in African origin research, which suggests that Modern AAE is derived from a process of linguistic influence whereby the variety of West African languages spoken by slaves and brought to the United States integrated with American English and created new forms (Alleyne, 1971; Baugh, 1999; Labov, 1998; Rickford, 1997; Smith, 1977, Welmers, 1973; Wolfram, 1991). This may suggest that features of AAE are the outcome of a merging process that took place when African slaves learned English as a second language and created a unique system (Green, 2004). Key evidence in this set of *difference theories* – so named for their focus on how the dialect is defined by ancestral languages – are correlations between morphosyntactic markers of various West African languages (primarily the Niger-Congo and Bantu language regions), such as the increased specification for aspect and tense in the use of stressed *been/ remote* BIN to impart an activity in the remote past; these auxiliaries can be used with a temporal adverbial, confirming their aspectual function (e.g., *I been/BIN cooking at home for a month'* to mean, 'I have been in the habit of cooking at home starting a month ago and still do'). Discussion of phonological markers of AAE are outside the scope of this investigation, but researchers have also shown evidence of West African language influence in the consonant clusters present in AAE today (Ladefoged, 1968; Holloway & Vass, 1993).

Opposing this view are the far less supported *deficit theories*, which posit that AAE developed as a byproduct of limited education regarding "proper" English forms for slaves and their descendants. This approach offers a view of AAE as a conglomerate of various "deficient" MAE forms, rather than as a distinct linguistic system influenced by several African language systems (for a review, see Morgan, 1994). Modern deficit theorists point to reduced test scores and academic achievement in speakers of AAE (Harris & Graham, 2007).

The historical focus on prescriptive grammars, and ongoing educational inequalities has played no small part in the discriminatory issues facing African Americans today. Given that language and society are inextricably connected, the following section provides some history regarding how the deficit view has impacted our social awareness of African American English as a dialect, and continues to feed modern misconceptions of NMAE varieties.

2.3.2 Social Views of AAE.

Until the late 1960s, anthropological scholars contended that because African Americans' ancestors were enslaved, they had been deprived of culture and education, which negatively impacted their behavior, including language (Herskovits, [1941] 1990). Against the backdrop of the American Civil Rights Movement, *deficit* beliefs were defended: "The Negro is only an American and nothing else. He has no values and culture to guard and protect" (Glazer & Moynihan, 1963, p. 53). Education and society treated features seen in the language of African Americans not as cultural differences, but rather pathology; as a result of which neither the language variety nor its features were provided with a classification. In part, this was due to social beliefs that African Americans were not culturally distinct from Anglo Americans, thus any behavior that was not similar was considered deviant (Morgan, 1994; Kochman, 1981). Eugenic theories of the 1940s also played a part, by furthering the belief that certain characteristics are hereditary by nature and cannot be influenced by environment (Boas, 1940). The language and behavior of Black people under these views was seen as exclusively social, and interpreted as either "distortions of white behavior" or as "pathological responses to the oppressive forces of caste and class" (Kochman, 1981, p. 8). Overall, the country's reluctance to define the African American experience and language as a cultural one fortified deficit theories of language use, leaving a vestigial mark on the modern conversation of language and race.

In the late 1960s, a catalogue of African language features seen originally in Gullah emerged as having connections to AAE, and soon a body of research began illuminating the regularities and structure of African American English as a rule-governed language system (Dalby, 1972; Stewart, 1967; 1968; 1969; Labov, 1972; Dillard, 1968; 1972). Gullah – also known as Geechee, or Sea Island Creole English – is an English variety spoken by African Americans in the coastal areas of South Carolina and Georgia (Turner, 1949). Following this initial outpouring of research, William Labov and several other scholars began the work of determining and documenting the properties and characteristics of AAE, by performing systematic linguistic analysis (Labov, 1977; Wolfram, 1969; Smitherman, 1977; Rickford, 1979; Reveron, 1978). A wave of linguistic evidence soon followed, which delineated features across discourse types, demonstrating that African American English held to certain immutable rules the same as any other language variety, thereby successfully discrediting previously held deficit theories (Baratz & Baratz, 1970; Kochman, 1981; Dillard, 1968; 1972).

In current literature, AAE is discussed by scholars across disciplines – from sociology, anthropology, linguistics, education and psychology – and their framework of discussion suggests the conditions and contexts from which AAE emerged. Debate between linguists remains as to whether AAE should be discussed in relation to features of African languages or if it should only be defined in comparison to MAE, across interactions and contexts. In education, school systems have struggled with the intention to deliver relevant and empowering curriculums to AAE-speaking students, who will likely also face language-based discrimination, since many communities still hold prejudiced beliefs about language use, rooted in deficit theories. The following section introduces some of the varying beliefs about dialect differences held by people both within and outside of AAE-speaking communities.

2.3.3 Differing Attitudes Toward Distinct AAE Features.

People who speak a dialect that differs from the mainstream language variety have long been subject to negative social judgments from both outside and within their speech communities. Many have reported that within the community of AAE speakers there has been a "consistent resistance" to the identification of AAE as a dialect with defined features, based on fears that it is "perpetuating racist stereotypes" rather than discrediting them (Morgan, 1994, p. 6). Usage and associated attitudes surrounding AAE develop across the lifespan, and specific demographic factors such as age, income and gender have been found to have an impact on stylistic variation (Wolfram, Adger & Christian, 1999).

Literature on child AAE production suggests that children from middle SES homes demonstrate fewer non-standard features than children from low SES environments (Dillard, 1972; Ratusnik & Koenigsknecht, 1975; Reveron, 1978; Washington & Craig, 1998). Nonetheless, middle class Black students and their families have been shown to regularly use AAE as well, and this reflects the idea that AAE use represents community identity (Ogbu, 2003). Within the same working class income group, research on age grading patterns in AAE speakers found decreased usage of AAE features in the language of adults and elderly African Americans, compared to adolescents (Rickford, 1999; Wolfram 1969; Labov et al., 1968). Another pattern found is that adult males tend to use more AAE forms than females within the same linguistic community (Labov, 1990; Wolfram, 1974). A similar gender effect has been seen in children (Horton-Ikard & Miller, 2004).

Across demographic variables, some have cited differences in speakers' beliefs about the *types* of features used in a dialect, which have been believed to be variably 'wrong' to the group that speaks it. For example, within the AAE-speaking community individual features of the dialect are differently stigmatized, such as the use of 'ain't,' which is considered by some AAE speakers to be 'incorrect' language use (Adger, Wolfram & Christian, 2007). Overall, AAE linguists and researchers have reported that dialectal differences in grammar use are generally more discouraged by speakers than those in pronunciation (i.e., phonology), which tend to be more readily tolerated as regional accents rather than being viewed as representative of social class or level of education (Adger, Wolfram & Christian, 2007). Under this assumption, a person substituting /f/ for /θ/ (e.g., teeth → /*tif/*) might be thought to produce acceptable language and/or have a accent, whereas the same person substituting 'ain't' for 'is not,' (e.g., *That ain't mine*) would be thought to have incorrect grammar or be producing 'broken English.'

For example, a change in verb suffix – the target of the current study – can be seen in many dialects and is a grammatical difference, which readily distinguishes it as a feature of a different language variety. This is instantiated by the fact that –ed and –s suffixes, used to mark past and third person singular tense on verbs (e.g., *They walk<u>ed</u>* and *The dog bark<u>s</u>*) are variably used (i.e., may be omitted or included) in AAE, to a greater or lesser degree, depending on the context and subpopulation of a given region. Conversely, addition of the –s suffix on present tense verbs in some Appalachian and Southern dialect communities is often observed in utterances with a plural subject (e.g., *A lot of them goe<u>s</u>*). This common variation of suffix use across many NMAEs is one of the reasons that processing of verb suffixes has been chosen as a target feature of analysis in the proposed study. Suffixes are particularly prone to dialect variation because in English they are often redundant with regard to meaning, when used in non-obligatory contexts (e.g. as a plural marker in an overtly plural context, such as *She has <u>two</u> shoe<u>s</u>*). In fact, the English language as a whole has been gradually losing these non-obligatory suffix forms for years, as speakers standardize exceptional forms (e.g., the modern absence of the old English forms *goe*, *goest* and *goeth*).

2.3.4 Misconceptions About AAE Usage.

Several misconceptions exist regarding AAE usage. Widely held beliefs that AAE constitutes a lesser language system exemplify the stigma and discrimination toward a minority dialect spoken by Black people. These historical notions are worth noting here, because they inform public opinions regarding a language variety, and contribute to the ongoing bias in American society against NMAEs. Two areas in which misconceptions exist very clearly are music and education.

It is often presumed that hip-hop music is replete with features of AAE. However, despite having a strong connection to AAE because of its creation in and by the African American population, some research on the topic shows that AAE features are only used on a token basis in hip-hop songs. One effect of this selective use is that the music is therefore more available to an expansive audience, which consists of many non-speakers of AAE (Edwards, 1998). Some of these non-speakers of AAE are also hip-hop artists, who use features of the language variety to create a sense of authenticity in their music. This act of using a language variety that is associated with a social or ethnic group to which one does not belong is known as “crossing” (Rampton, 1995). Actualization of this concept is popularly discussed in relation to hip-hop music internationally, where artists may be seen to use AAE in their music, but not in their public speech (Eberhardt, 2015), reflecting a diglossic example of domain-specific use of distinct language varieties.

Another area where misconceptions regarding dialect use occur frequently is in education. The ongoing debate regarding the use of AAE by children in schools made national headlines most recently on December 18, 1996, when the Oakland Unified School District passed a resolution stating it “officially recognizes the existence, and the cultural and historic bases of West and Niger-Congo African Language Systems, and each language as the predominantly primary language of African-American students” (p. A18).

Misunderstandings and outrage that the Oakland school district intended to teach AAE – then more widely known as ‘Ebonics’ – in classrooms fueled arguments about the promotion of ‘broken’ English in schools (Wolfram, 1998; Smitherman, 1998). These schools reminded the public of the 1974 *Martin Luther King Junior Elementary School Children et al. v. Ann Arbor School District* ruling, which granted school children the legal right to use their home language and dialect in educational settings. The Oakland school district approached the growing literacy gap between Black and White students by granting the right of schools to use their students’ first language variety as a pedagogical tool, a ruling that increased research interests in dialect awareness programs in education (Harris & Schroeder, 2013; see section 2.4.2 *AAE Research in Education*). Since then, AAE developmental norms for typical bidialectal speakers have been researched and documented for use in education, social work, and speech and language treatment for minority dialect groups (Craig, et al, 2003; Craig & Washington, 2004; Ivy & Masterson, 2011). Knowledge of these developmental milestones is crucial for facilitating language and literacy development in bidialectal speakers.

Misconceptions about a language variety create powerful belief systems, which impact people individually and institutionally. Some sociolinguistic studies have found that language discrimination has affected speakers' ease or ability in finding gainful employment and even housing, if they exhibited features of a minority dialect in their spoken or written language (e.g., Massey & Lundy, 2001; Purnell, Idsardi & Baugh, 1999). Like most discriminatory actions, some patterns of language production are more stigmatized than others, indicating the need for increased understanding of what a dialect is and how it functions as a language variety in the brain. What follows next is a transdisciplinary review of the current research in AAE, including background on frequent terms and select methodology.

2.4 Current AAE Work

2.4.1 Measuring AAE Features and Views on Dialect Shifting.

AAE research investigating the occurrence of dialect features is often performed by collecting natural and spontaneous language samples produced by native speakers, which are then transcribed and described in several ways. A dialect density measure (DDM) is one widely used method for indexing number and type of dialect features in a person's speech in different contexts (Oetting & McDonald, 2002). How the DDM is calculated can vary, but one common method is by dividing total number of observed dialectal patterns by the total number of utterances in the sample, which provides a ratio of how much of the speaker's language is marked by dialect features (Oetting & McDonald, 2002). When a speaker shifts dialects from the minority variety to the mainstream language variety, it is expected that DDMs will decrease, since DDMs are measured against the mainstream language as the 'standard' for comparison. This language shift is often known as *codeswitching*, in all varieties, but is sometimes referred to as *dialect shifting*, to differentiate it from other codeswitching situations (e.g., Spanish → English).

The issue of dialect shifting has significant implications for the field of education. Dialect shifting has been measured by a decrease in DDMs when speaking MAE. Based on this, a dialect-shifting hypothesis has been presented, which posits that children who learn to dialect shift in relevant situations demonstrate improved performance on academic tasks such as reading and writing in MAE, compared to children with increased DDMs (Charity et al., 2004; Connor & Craig, 2006; Craig & Washington, 2004; Kohler et al., 2007; Terry, 2006). In some studies, where children whose AAE production rates were found to be inversely proportional to their reading performance, it has been suggested that these students possess an "insufficient knowledge of SAE [MAE] and an inability to dialect shift to SAE [MAE] in literacy contexts that require this adaptation" (Craig, et al., 2009, p. 841).

Research on improved dialect shifting, as measured by a decrease in DDMs when attempting to speak MAE, has received some criticism. This is because it has promoted an educational curriculum of dialect awareness programs that some researchers deem harmful to the populations they serve, with effects including lowered self-esteem, reduced racial self-concept and reduced language confidence in the classroom (Cassar, 2008). Consequently, some advocates and educators have encouraged *codemeshing* as a paradigm for learning and curriculum development. Whereas codeswitching requires moving between two separate systems, *codemeshing* treats the language varieties as one integrated system (Canagarajah, 2011). Codemeshing is a term used by scholars who oppose the dialect-shifting hypothesis, to describe, "a blending of discourses, a diglossic, if not heteroglossic (multi-voiced) approach to speaking and writing" (Young, et al., 2014, p. xiii). Proponents of codemeshing hold that the correlation between increased AAE features and lowered standardized reading scores does not reflect an impoverished knowledge of MAE, but instead is indicative of the consequences of a forced and unnatural monodialectalism. In fact, some research on codemeshing in academic settings evidenced greater writing scores on national exams, with written narratives incorporating features of AAE (Smitherman, 1994). Another study demonstrated that increased DDMs in AAE students' language were also correlated with more complex syntax (Craig & Washington, 1994). This preliminary work suggests that a greater understanding of the linguistic resources available to AAE speakers may lead to a richer discourse in and about our students who speak AAE, whose language use may otherwise go overlooked or penalized for being ungrammatical. In some ways, codemeshing is proposing a standardization of AAE use, as is often the case with communities where the colloquial variety establishes itself across domains and modalities (Ferguson, 1959).

2.4.2 History of AAE use in schools.

Research in applied linguistics has demonstrated that second language teaching techniques require a different understanding of cultural differences with regard to dialect than what is required when teaching the mainstream language to a speaker of a foreign language (i.e., MAE as a second dialect versus MAE as a second language). Second dialect speakers of MAE face a *functional interference*, a sociolinguistic situation wherein minority speakers want to maintain their cultural identity, as represented by their dialect, which separates a marginalized group from the mainstream community (Johnson, 1979). Speakers of foreign languages learning English as a second language are typically surrounded by English L1 speakers and are immersed in the system they are learning. They are therefore given inherently rewarding feedback for its use in communication. This is not the case for the majority of speakers for whom MAE is a second dialect, whose taught language variety (e.g., MAE) is not represented or preferred by their social environment (e.g., AAE in the home and community; Delpitt, 1995, Wolfram & Schilling-Estes, 1998).

Dialect awareness programs continue however, with the hope of reducing the discrimination experienced by those whose language variety is stigmatized and not a part of the educational curriculum. The goal of these programs is to emphasize the equal validity and importance of both dialects, while improving development of metalinguistic awareness for both language varieties. Some research has shown that several programs like this, which include some reflection on similarities and differences between dialects, have improved MAE literacy outcomes (Terry, Connor, Thomas-Tate & Love, 2010; Terry, 2006). While not as widespread as English as a Second Language (ESL) programs (developed to support bilingual learners), some school curriculums are attempting to support language development in dialect speakers by employing dialect awareness programs, such as the Mainstream English Language Development (MELD) program carried out in the LA Unified School District (LeMoine, 2007). The MELD program is designed to support explicit dialect awareness for Standard English Language (SEL) learners.

Dialect awareness programs differ in their curriculum and intentions, representing the institutions' preferences for approaches involving more dialect shifting (i.e., codeswitching) or dialect integration (i.e., codemeshing). While some programs teach contrasting features and provide explicit instruction on domain use of a given dialect (i.e., dialect shifting paradigms), others increase awareness of spoken and written features of each dialect, while encouraging use of all language features available to students (i.e., codemeshing paradigms). In most programs, teaching MAE to speakers of AAE requires an identification of contrasting features between the two dialects, meaning that children are explicitly taught what semantic, phonological and grammatical features of the native language variety do not belong to the taught variety (Johnson, 1979).

In education, the use of dialect in the classroom has been studied in order to allay fears that 'teaching' dialects would result in negative academic outcomes and deprive children of the standard language instruction needed for success (Nero, 2006; Snow, 1990). Arguments against the use of AAE in the classroom have been posited on the basis that it prevents immersion in the standard variety, that the dialects are not dissimilar enough, that there are no positive effects for its use, and that educators will find it impractical to employ (McWhorter, 1998, 2000). Benefits of bringing dialects into the classroom have been evidenced, affirming that vernaculars are legitimate, rule governed forms of language and that there is no evidence to support claims against their use. Studies listed in Table 2 below were borrowed from Siegel's work on dialect accommodation and awareness in the classroom, and all provide evidence of positive outcomes in educational programs around the world with dialect awareness components (Siegel, 2006, p. 50).

Table 2: *Programs with a Dialect Awareness Component*

Variety	Study	Level
Hawai'i Creole (Project Holopono)	Actouka & Lai, 1989	Grades 4 – 6
Hawai'i Creole (Project Akamai)	Afaga & Lai, 1994	Grades 9 – 10
Caribbean Creole (Virgin Islands)	Elasser & Irvine, 1987	College
Belize Creole	Decker, 2000	Grade 3
Caribbean English Creoles in US (Caribbean Academic Programs)	Fischer, 1992b	High School
AAE	Hoover, 1991	College
AAE	Scherloh, 1991	Adult
AAE (Bidialectal Communication Program)	See Rickford, 2002	Grades 5 – 6
AAE and other vernaculars (Academic English Mastery Program)	Maddahian & Sandamela, 2000	Elementary

Note. Adapted from Siegel, 2006, p.50, Table 2.2

The discussion as to whether dialect awareness programs negatively impact students or improve academic outcomes continues, as research increases our understanding of how the AAE and MAE language varieties function. Are they more like two language systems that must be codeswitched, or like a single system wherein registers are shifted? If they function more like two linguistic systems, then how useful can dialect awareness programs be, compared to more explicit programs like those for English Language Learners? Interest in understanding how these dialect varieties impact reading and writing development in MAE (and thus academic achievement overall) is ongoing at the local and national level.

2.4.3 Academic Achievement Gaps and Language Use.

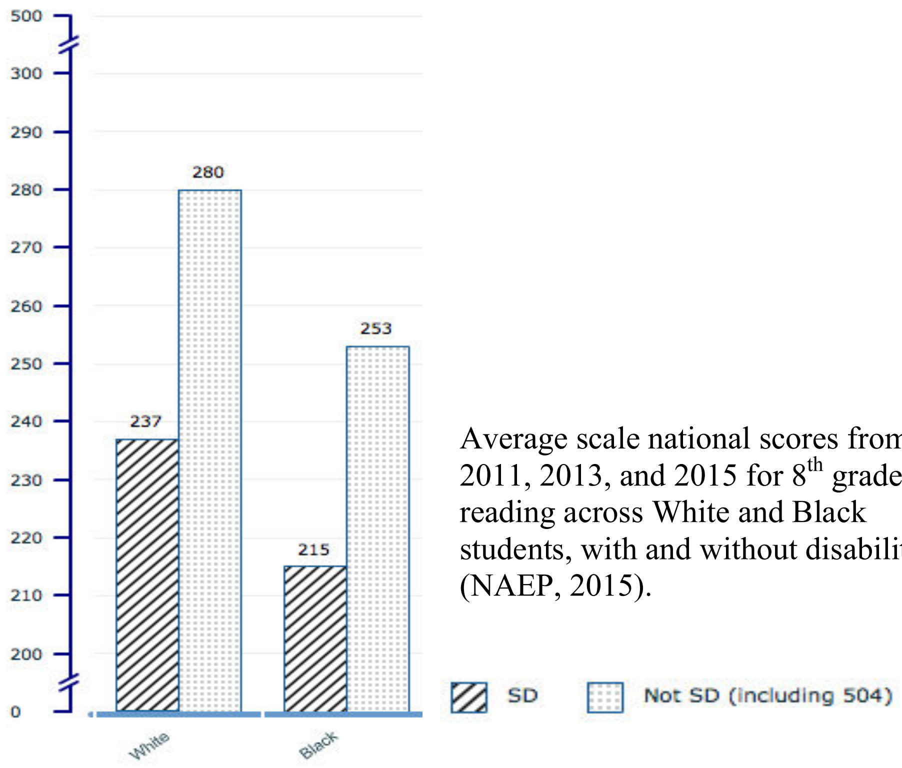
Some researchers investigating the educational achievements of AAE speakers have looked to family history and vocabulary development as major indicators of success in school. For example, in *The Black-White Test Score Gap*, Jencks and Phillips (2011) provided data from the National Longitudinal Survey of Youth (NLSY), which tested Black and White children on the Peabody Picture Vocabulary Test (PPVT–III) and demonstrated a 16 point difference between the groups, with lower scores for five and six year old children who are Black (see Fig. 1; Dunn & Dunn, 1997). In this large-scale study of over 3000 children (White n = 2,071, Black n = 1,134), this vocabulary disparity could not be correlated to traditional measures of parental educational background and economic inequality (i.e., current general socioeconomic status of parents). Instead, Jencks and Phillips (2011) argued that differences in participant mothers' socioeconomic status growing up and parenting styles offered a more effective explanation. Additional evidence that cultural factors affect how Black children and White children are taught to approach learning was provided by demonstrating that lower scores on vocabulary tests were not dramatically changed when words were confined to those with similar levels of exposure, indicating instead that decisions about what comprises intelligence – specifically, what aspects of learning are culturally valued – may play a larger role than race in explaining academic disparities.

Because many studies of AAE speakers' educational achievement have focused on semantic knowledge there has been a tendency to question dialect use and academic achievement. While dialect may play a role in academic achievement in most U.S. curriculums, vocabulary knowledge is only one aspect of language use and skill, therefore many of these studies succumb to a *construct-validity bias*. Also known as *labeling bias*, the construct validity of a test is determined by its ability to actually measure what it claims to measure. For instance, in the Jencks and Philips (2011) study discussed above, the measure used (PPVT–III) is one of vocabulary knowledge, which does not account for the acquisition of morphology, syntax or phonology in a given language variety. This is an important distinction, since some research has suggested that the acquisition of morphosyntactic knowledge may be subject to a critical developmental period, even across dialects. In one experiment, morphological awareness for derivational suffixes alone (e.g., the ability to change the adjective 'hot' into the noun 'hotness') has been positively correlated with reading ability up into the higher elementary grades (Singson, Mahony & Mann, 2000). These findings imply that grammatical differences between language varieties cannot be absent from the discussion of NMAE groups and academic achievement, as impacted by language use. Even in situations where dialects are mutually understood, if morphology differs between the language varieties, then language development will impact reading and writing development in a given variety.

The National Center for Education Sciences (NCES) provides publicly available data collected by the National Assessment of Educational Progress (NAEP), which allows performance comparisons of nationwide standardized tests on reading at the 4th and 8th grade level. In 2013, fourth grade White students scored an average 26 more points on national reading assessments, compared to Black student peers, along a standard scale (Black student mean = 206, standard error 0.5; White student mean = 232, standard error 0.3). In terms of cumulative reading achievement, these scores indicate that 12% of Black 4th graders are at or above a *proficient* level, compared to 46% of their White peers (scale levels organized by *below basic*, *above basic*, *proficient* and *advanced*). As can been seen in Figure 1, students with disabilities who receive services under the Individuals with Disabilities Education Act (IDEA; excluding 504 plans) demonstrate an even greater gap when comparing between racially White and Black clients, representing the inequality in service provision overall (NCES, 2015).

We should be cautious about targeting any one demographic factor as the cause for underachievement at school, be it social class, dialect or racial group. Some known patterns have emerged which indicate that the level and degree of poverty negatively correlates with student academic success and performance on national assessments (Keating & Schulte, 2001). Similarly, children living at or below the poverty line are 1.3 times as likely as children from middle-income homes to be diagnosed with learning disabilities and developmental delays (Brookes-Gunn & Duncan, 1997). If demographic data were clear-cut, it would be simple to attribute AAE patterns to a racial group that lives in poverty and is known to underperform in school. But middle class African American children use AAE patterns, too, and there already exists a call for investigations of different subgroups which are not often studied and might expose more complex relationships between academic achievement, language, income and race (Horton-Ikard & Miller, 2004; Boult, 2007; Ogbu, 2003).

Findings from this study offer an additional understanding of language processing in the AAE-speaking population, which may impact service provision by educators, and various clinicians in special education. Service inequality is a topic of particular interest in the field of speech-language pathology, where clinicians frequently struggle to differentiate difference from disorder in NMAE populations (Rodekohr & Haynes, 2001; Seymour, Bland, Stewart & Green, 1998).



Average scale national scores from 2011, 2013, and 2015 for 8th grade reading across White and Black students, with and without disability (NAEP, 2015).

Figure 1. *National Reading Scores by Race and Disability Status.* Data about students with disabilities (SD) who receive mandated special education are shown separately from children without disabilities, including those who may receive accommodations under section 504 of the Individual with Disabilities Act (IDEA), but do not have an individualized education plan (IEP). This graph was generated using the data explorer tool on the NAEP site: https://nces.ed.gov/nationsreportcard/naepdata/dataset.aspx

2.4.4 AAE Research in Speech-language Pathology.

Much of the existing work on AAE from the speech-language pathology (SLP) perspective is focused on children who are being referred for evaluation in schools (e.g., Seymour, Bland-Stewart & Green, 1998; Robinson & Stockman, 2004). Some notable exceptions arrive out of investigations into an aging population of AAE speakers who have sustained a cerebrovascular accident (CVA) resulting in aphasia (e.g., Ulatowska & Olness, 2001; 2003; Ulatowska, Ollness, Keebler & Tillery, 2006; Olness, Matteson, & Stewart, 2010). This comparative lack of adult AAE research across age groups is problematic for patients needing clinicians with an increased understanding of dialectal language representation in the brain, and a motivating factor in starting a programmatic course of research with the proposed study.

The SLP field at large is sorely lacking in efficacy studies for diverse groups across the lifespan, with much research currently focused on children and on the provision of services in schools. Respondents to a 2008 national survey of accredited SLP and audiology programs reported minimal exposure to diversity issues in their professional preparation (Stockman, Boult, & Robinson, 2008). Minority children have long been overrepresented in special education programs and services and underrepresented in gifted and talented (GT) programs (Heller, Holtzman, & Messick, 1982; Hosp & Reschly, 2003). Misdiagnosis of language impairment is more common in culturally and linguistically diverse (CLD) children than monolingual children of the same age, due to the lack of unbiased standardized assessments, underlining the need for alternative assessments and increased knowledge of dialects (Bedore & Peña, 2008; Peña et al., 2006; Scheffner-Hammer et al., 2002 Cole & Taylor, 1990; Laing & Kamhi, 2003; Robinson & Stockman, 2009). Effects of labeling and segregation of children with Individualized Education Plans (IEPs), which delineate their mandated services, can stigmatize children and lead to deleterious effects on their educational achievement, thus perpetuating gaps in achievement on national test scores and other outcome measures.

African American children as a group have received particular attention in the research of speech and language development and disorders, because of the difficulties experienced by SLPs when attempting to perform differential diagnoses regarding an American English language variety with which they are unfamiliar (Seymour, Bland Stewart, & Green, 1998; Wyatt, 1995). Out of 148,105 certified SLPs in the American Speech and Hearing Association (ASHA), 4,036 identify as Black or African American, with 7.8% identifying as a racial minority overall (ASHA, 2014). Data from the National Center for Education Statistics in 2012-2013 showed that 186,038 racially Black children aged 3-21 years received services for a speech and/or language impairment, demonstrating a need not only for increased representation of African American SLPs, but for increased cultural competence in all SLPs to provide treatment to children who speak minority dialects (NCES, 2015).

Clinicians' reliance on standardized assessments to inform clinical decision-making can lead to misleading outcomes with CLD populations. For example, Cole and Taylor (1990) showed that three frequently used standardized articulation and phonology assessments led to a misdiagnosis of disorders in up to 50% of referrals for typically-developing 6 year-olds who speak AAE. Such misdiagnoses can lead to children receiving inappropriate labels in their educational careers, allocation of resources for the provision of unnecessary SLP services, and hence diminished availability of resources for a disordered population in need of treatment.

Some researchers have sought to find alternate methods for more sensitive assessment of language and communication in these populations and have discovered some measures that may better differentiate between dialect and disorder (see Laing & Kamhi, 2003 for a review). Content bias, linguistic bias, and disproportionate representation of NMAE speakers in norm-referenced tests are being counteracted by clinicians' use of processing-dependent and dynamic assessment procedures. Such approaches to assessment rely less on prior knowledge of the groups being tested, whose life experiences may differ from mainstream culture. Processing-dependent procedures test verbal and nonverbal working memory in children, and have been shown to elicit significantly different performances in children with and without language impairment (LI), but comparable results in typically-developing children across dialect groups (Rodekohr & Haynes, 2001; Campbell, Dollaghan, Needleman, & Janosky, 1997). Dynamic assessments include variations on standardized testing that accommodate language differences of CLD groups by use of graduated prompting, test-teach-retest, and naturalistic action-oriented test presentations, to more accurately measure children's ability to learn rather than their exposure to specific language forms and vocabulary (Bain & Olswang, 1995; Lidz & Peña, 1996; Ukrainetz, Harpell, Walsh, & Coyle, 2000; Fagundes, Haynes, Haak & Moran, 1998).

While many clinicians use alternative assessment procedures for children from CLD groups, the creation of standardized assessments sensitive to dialect differences is ongoing. Some researchers point out that the difficulty of this process stems from the need for specific administration for each minority dialect group, which is not currently available. Some of the current research in language testing for speakers of AAE is focused on developing non-discriminatory language and literacy evaluations for children, centering on more narrative and holistic approaches to assessing language disorders, since these have been found to be more comparable with accurate diagnosis than standardized tests alone (Craig, Washington, & Thompson, 2005; Pearson, Velleman, Bryant, & Charko, 2009; Stockman, 2002). Additionally some researchers have pointed to the ways in which dialect features are measured, and have advised practitioners to pay careful attention not only to the *type* of features found in NMAE language production, but also to the *frequency* of these features across groups (Oetting & McDonald, 2002; 2010). A case in point is the marking of *be* forms, which have been investigated in a southern Louisiana community to clarify how two groups of NMAE speakers – Southern White English (SWE) and Southern AAE (SAAE) – may be differentiated from those speakers who also demonstrate specific language impairment (SLI) or language disorder (LD) (Garrity & Oetting, 2010). The use of habitual *be* is often overlooked as also occurring in Caucasian speakers but is a known feature of SWE. In one study of child language, habitual *be* was observed in 9% of typical SWE speakers, compared to 22% of SWE speakers with Specific Language Impairment (SLI), suggesting that higher frequency could indicate impairment in this population (Oetting, Cantrell & Horohov, 1999). This finding was different from results in a comparison of SAAE to the same dialect group with LD, which demonstrated an equal marking of dialect specific forms of the verb *be* in children with and without impairment. Overt markings of *be* forms (e.g., *is, are, am*) overall however were lower in the LD group than in the typical, age-matched SAAE group during an elicitation probe.

These findings suggest that tallying behaviorally contrastive features of dialect groups alone is not enough to classify or understand *difference* versus *disorder* (Oetting, 2014). An understanding of the processing of language across linguistic groups is crucial to understanding both dialect specific and universal features, which can inform the field in a way as yet unexplored**.** The current study addresses the question of dialect representation as a system of language, so that it may also contribute to the discussion of neurolinguistic theories of bilingualism (Paradis, 1981; Paradis, 2004). According to the subsystems hypothesis of language representation, each language variety exists as a subset of neural connections, which is then supported by a single cognitive system (i.e., the language system). Under this hypothesis, mixing and switching patterns for bidialectal speakers who were raised in a context where both varieties are conceptualized as a single linguistic system, may therefore demonstrate lower 'interlanguage inhibition' when processing sentences with contrasting features (Paradis, 2004, p. 112; Wulfeck et al., 1986; MacWhinney, 1997). In the context of EEG, this might be observed by the appearance and/or modulation of distinct ERP components. The following section describes several ERPs related to language study using EEG methodology.

2.5 An Introduction to EEG and Evoked-Response Potentials (ERPs)

Prior to this section, this review has covered the current understanding and research of AAE and MAE in sociolinguistics, education and speech-language pathology. Electroencephalography (EEG) is another area of research for exploring linguistic differences, but before the current dissertation study, these methods had yet to be applied to the study of these American English language varieties. In the current study, EEG measures were used to provide some insight into morphosyntactic processing differences between speakers of two varieties of American English. EEG methodology was chosen for this study as an objective measure of specific aspects of language processing, because it offers a data collection method not reliant on behavioral responses or on conscious awareness of dialectal features and use.

As described further in Chapter 4, these results were collected and compared alongside behavioral results from a grammaticality judgment task.

EEG is a non-invasive technique for recording electrical activity related to intercellular communication in the brain. The EEG signal indexes brain activity by recording the cumulative voltage variations generated by large populations of neurons via electrodes placed firmly on the scalp (Öllinger, 2009; see also Chapter 4, Section 4.3 below: *EEG Methods & Specific Parameters* for this experiment). Event-related potentials (ERPs) are derived from the continuous EEG recording and occur in response to a particular stimulus presentation, providing information about neurophysiological processes associated with a specific stimulus-response. Electrodes are configured in a standardized fashion on the head, such that time-locked brain responses can be recorded over a predetermined region of the scalp, then averaged and compared. By averaging responses to repeated trials of a single cognitive event, the signal-to-noise ratio of the recordings is augmented, and voltages and peak latencies can be isolated, such that activations related primarily to the event of interest are represented in the averaged data, thus revealing the ERP (Luck, 2005; Rugg & Coles, 1995).

2.5.1 Language-related ERP signatures.

Since the 1980s, publications have cited the use of EEG recordings to measure the presence, amplitude and peak latency of ERPs for the study of neurocognitive tasks involved in speech and language processing (e.g., Kutas & Hillyard, 1980; Hagoort, 2008; Kaan, 2007). Studies using EEG recordings for language research are designed to capture the ERP signature relevant to a particular aspect of language representation or processing, in order to gain insights into cognitive-linguistic processing in neurotypical and atypical groups (Handy, 2005; Luck, 2005; Tucker, 1993). ERP analysis is especially suited for exploring rapid functions like language processing because the methodology offers high temporal resolution for electrical brain activations associated with discrete cognitive operations. Such operations are not typically reliably measurable using behavioral observations alone (e.g., reaction times) or via imaging techniques with less precise temporal sampling capabilities such as functional magnetic resonance imaging (fMRI) and positron emission tomography (PET) (Tucker, 1993). There are language-related ERP components known to represent brain activity related to the processing of phonology, semantics and morphology/syntax (e.g., Swaab, Ledoux, Camblin & Boudewyn, 2012; Kaan, 2007). Some ERP components found to be affected by language processing and/or correlated with specific linguistic functions include the MMN, the ELAN/LAN, the N400 and the P600. The present study builds on language research using all of these ERPs, but specifically investigates aspects of language processing by eliciting the P600. What follows is a brief description of these language-related ERP components, with a particular focus on the component of interest (P600) for comparing morphosyntactic processing between two dialects.

2.5.1.1 The Mismatch Negativity (MMN). The mismatch negativity (MMN) is a neurophysiological brain response that peaks approximately 150 to 300 milliseconds post-stimulus onset. The MMN is elicited by auditorily (or visually) discriminable stimuli, often presented in an oddball paradigm (Aaltonen, Niemi, Nyrke, & Tuhkanen, 1987; Friederici, 2002; Näätänen, Paavilainen, Rinne, & Alho, 2007). The MMN is considered to index preconscious change detection in the auditory domain, as it occurs when a deviant stimulus is presented in a stream of standard stimuli (Näätänen, et al., 2007; Escera, Yago, Polo, & Grau, 2000). The MMN component is a negative-going peak found in the *difference wave* after subtracting the average time-locked response elicited by standard sounds, from that elicited by deviant sounds. The MMN itself results from a greater negative-going voltage deflection in response to the deviant sounds, which differ from the standard sounds according to precisely controlled acoustic or phonetic properties such as pitch, duration, voice onset time, among others (Kaan, 2007). Source of the MMN have been localized near the primary auditory cortex (Heschl's gyrus), and the frontal lobe. Such activation sources are consistent with the interpretation that MMN reflects a violation of sensory memory built by responses to the standard sound for auditory processing (Phillips et al. 2000; Opitz et al. 2002; May & Tiitinen, 2010). In language research, the MMN has been elicited to explore speech perception at the phoneme level, with experiments designed to examine phonological categorization, and aspects of first and second language acquisition (e.g., Näätänen, et al., 1997; Werker & Tees, 1984; Phillips, 2001; for a review see Näätänen, Paavilainen, Rinne, & Alho, 2007).

2.5.1.2 The Early Left Anterior Negativity (ELAN). The early left anterior negativity (ELAN) is a component thought to represent a fast, automatic first-pass parse of syntactic word category information (e.g., Neville et al., 1991; to them, 'N125'). The ELAN effect is cited as reflecting the brain's initial phrase structure building processes (Hahne & Friederici, 1999; for a review, see Steinhauer & Drury, 2012). The ELAN occurs approximately 100 to 200 milliseconds post-stimulus onset. Its neural generators have been localized to the inferior frontal gyrus and the anterior temporal lobe. In language research investigating bilingual language processing, monolinguals and bilinguals showed differential effects for an ELAN (N125) and for a second left lateralized negativity (N300 +/- 500ms), which were followed by a P600 effect (Weber-Fox & Neville, 1996; see below for discussion of this component). The ELAN has been shown to be sensitive to maturational constraints in speakers with variable language exposure, suggesting that proficiency plays a large role, since the ELAN is elicited with a shorter latency or greater amplitude when speakers are very fluent (Ojima, Nakata & Kakigi, 2005; Rossi, Gugler Friederici & Hahne, 2006). In experiments where an ELAN was expected but not observed, it has been suggested that stimuli must contain "outright syntactic violations" rather than "unusual structures" (Friederici, 2002, p.82).

2.5.1.3 The N200. The N200 is a negative-going component that appears approximately 200 milliseconds post stimulus onset and has been related to information access in studies of word production (Jansma, Rodriguez-Fornells, Möller, & Münte, 2004). In Go-NoGo experimental paradigms, where responding accurately to a stimulus requires inhibition of responses to other stimuli, an N200 can be observed over fronto-central scalp electrodes (Kaan, 2007). In bilingual research experiments that target the N200, the stimulus language, presentation order, and word category have been manipulated to investigate the cognitive order of access to various aspects of linguistic information in speakers of two or more languages (Rodriguez-Fornells, Van Der Lugt, Rotte, Britti, Heinze & Münte, 2005). The timing of the N200 elicitation during inhibitory responses has informed our understanding of how phonological and grammatical gender are simultaneously accessed in bilinguals during decision-making tasks.

2.5.1.4 The Left Anterior Negativity (LAN). The left anterior negativity (LAN) is a negative-going component appearing 300-400 milliseconds post-stimulus onset. Despite appearing in the same time frame as the N400 (described below), it has a different scalp distribution over the left inferior frontal lobe (lending it its name), similar to the ELAN. It is elicited in response to grammatical violations and often precedes a P600 effect (Münte, Heinze, & Mangun, 1993; Rösler, Pütz, Friderici, & Hahne, 1993; Kutas & Hillyard, 1983). In multilingual research, the appearance of the LAN has been correlated with native proficiency in a language, and increased working memory load during online grammaticality judgment tasks in non-native speakers (Hahne, 2001; Hahne & Friederici, 2001). These findings suggest that exposure to a language variety may impact the appearance and/or timing of the LAN (and P600) effect.

2.5.1.5 The N400. Semantic processing of words and sentences for the past 30 years has been investigated by eliciting the N400 component, which is correlated with the processing of semantically anomalous words within a given context (Kutas & Hillyard, 1980; Kaan, 2007). The N400 is a negative-going voltage deflection, and peaks between 300 to 500 milliseconds post-stimulus onset. Since all content words elicit an N400 response, the N400 effect is measured as the difference in amplitude between two conditions; one containing a semantic anomaly and one without (e.g., *He spread the warm bread with butter/socks*) (Kutas & Hillyard, 1980). Neural generators for the N400 have been localized to several areas in the anterior temporal lobe and its elicitation is thought to reflect semantic integration costs when a stimulus is unexpected with respect to the preceding context in a linguistic or visual sequence (Van Petten and Luka, 2006; Van Berkum et al., 1999; West & Holcomb, 2002; Sitnikova et al., 2003). In language research, the N400 has been elicited to explore semantic and lexical processing of words and images in various contexts, across populations (for a review, see Kutas & Federmeier, 2011).

2.5.1.6 The P600. The P600 is the ERP component targeted in this study. In language research, the P600 has been elicited in response to ungrammatical and unpreferred (marked) sentence constructions and is thought to represent brain activity related to repair and reanalysis of the construction, and reintegration between semantic and syntactic structures that encounter mismatches during processing – such as garden-path sentences (e.g., Osterhout, Holcomb & Swinney, 1994; Osterhout & Holcomb 1992; Hagoort, Brown, & Groothusen, 1993). It is most consistently observed over posterior regions of the scalp, initiating between 500-1000ms following event detection, with a peak amplitude generally occurring near to 600ms. The P600 is unique for remaining at peak amplitude for up to 400ms, ending in what is described as a slow shift back to baseline (Hagoort, et al., 1993; Steinhauer & Drury, 2014; see Figure 2 below). Due to its characteristic presentation and the varied cognitive processes that its elicitation is thought to represent, the P600 is also referred to in the literature as the late positive component (LPC) or the syntactic positive shift (SPS).

The types of events that elicit a P600 brain response are varied but share the common characteristics of error detection and/or reanalysis of some stimuli in a sequence. These include but are not limited to the presence of phrase structure difficulties or violations (Featherston Matthias & Münte, 2000), the processing of garden path sentences (Hagoort, et al., 1993), or even the recognition of music being unexpectedly played out of tune (Patel, Gibson, Ratner, Besson & Holcomb, 1998). Figure 2 illustrates how the P600 is elicited by the presentation of a morphosyntactic violation, even in a semantically incoherent sentence. It also demonstrates how the P600 wave appears and lingers for a period of time following a time-locked event (e.g., the verb *smoke/s*) in a sentence. The present progressive '-s' marker seen in the Hagoort (2008) study featured in Figure 2 is also the target stimulus in the current dissertation study.

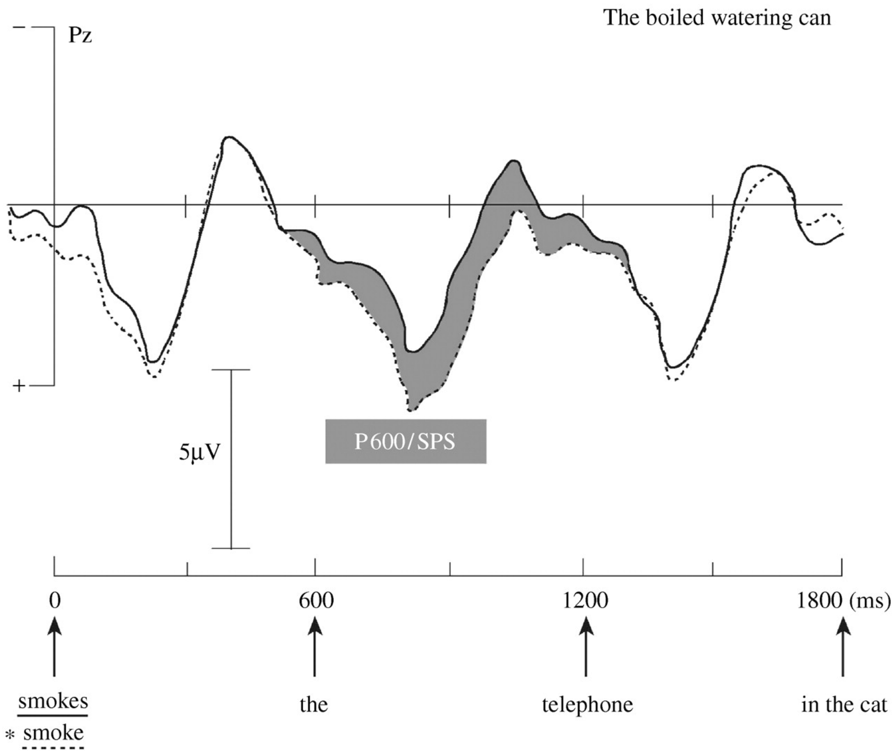


Figure 2. *Illustration of the SPS (i.e., P600) component.* Plotted positive down in this study, these stimuli controlled for semantic anomaly by presenting semantically incoherent sentences, containing a single syntax error. Reproduced from Hagoort (2008), permitted under Creative Commons Attribution License.

In order to identify the P600 effect, the wave observed in response to target stimuli must demonstrate a more positive amplitude than that elicited in the control condition. In the Hagoort (2008) study referenced in figure 2 above, results from the trials with omitted '-s' were averaged (represented as the dashed line in figure 2), for comparison against the averaged ERP responses in the control condition (represented as the solid line in figure 2). In language research, the P600 effect has been elicited in response to both written and auditory stimuli, with delayed peak amplitudes seen in L2 speakers when compared to native speakers, similar to findings in ELAN/LAN investigations (e.g., Stowe & Sabourin, 2005).

The following section is a review of ERP research related to dialectal and diglossic language processing, leading to the resulting research topic and dissertation study.

2.5.2 Electroencephalographic Research on Multidialectal Populations.

Researchers studying bilingualism, multilingualism, and dialects have used EEG to derive insights into how the brain accesses and manipulates multiple language varieties.

Some have done this by capturing and measuring the ERP responses for processing codeswitches between linguistic systems (e.g., Jackson, Swainson Cunnington & Mullin, 2004; Jackson, Jackson & Roberts, 1999; Meuter & Allport 1999; Moreno, Federmeier and Kutas, 2002). Distinct ERP responses to the processing of L1 and L2 languages are well documented (Friederici, Meyer & von Cramon, 2000; Hahne, 2001). A speaker's L1 generally refers to the language variety that was acquired natively and/or is the dominant language variety across domains; L2 refers to the language variety acquired second and/or less dominant language variety of a speaker. With dialects, however, this is often a challenging distinction, since not all varieties are consciously used or switched by its speakers (see section 2.1), therefore L1 and L2 will be descriptors only for the purpose of reviewing the relevant research that has informed the present investigation.

Support for the P600 as a target in the current study can be found in investigations where distinct ERP signatures were associated with codeswitching between traditionally distinct language varieties (e.g., Spanish and English), as well as between two language varieties generally considered to be dialects of the same language (e.g., diglossia in Arabic). In one such study, Moreno et al. (2002) compared the between-language shifts of English-Spanish bilinguals to within-language lexical switches for text stimuli. Participants were presented with written sentences in either English or Spanish with the final word presented in one of three conditions: expected/control (e.g., *She heard a knock on the door*), lexical switch/unexpected (e.g., *She heard a knock on the entrance*) and codeswitched (e.g., *She heard a knock on the puerta*). ERP responses to within-language (lexical) shifts were compared to between-language (codeswitched) shifts and results revealed that unexpected, within-language, lexical shifts elicited a significant N400 effect (with no P600/LPC), whereas between-language switches elicited significant ELAN/LAN and P600/LPC responses. These findings indicate a similarity of processing between codeswitching and morphosyntactic operations. Further, it suggests that the P600 response to codeswitched conditions may be associated with a shift between language varieties.

Another set of experiments gave support to this interpretation, by demonstrating similar ERP responses for processes across two language varieties of speakers within a diglossic situation in Arabic (Khamis-Dakwar & Froud, 2007). For that study, processing of a sentence in a spoken-language variety (Palestinian Colloquial Arabic; PCA) was compared to another variety that has both written and spoken modalities (Modern Standard Arabic; MSA). Stimuli were all presented auditorily under the following conditions: crosslinguistic codeswitch (MSA to PCA or vice versa); within-variety lexical switch (semantic mismatch);

and control sentences (no switch). Cross-linguistic switches between dialect varieties in a sentence were found to significantly enhance P600 effects, similar to the English/Spanish between-language switch response demonstrated previously by Moreno, et al. (2002). Within-language semantic switches, however, elicited a significant N400 response only in MSA, which the authors suggested might be attributable to evidence that MSA functions as an L2 for these dialect users, thus presenting more unfamiliar words overall; this is compared to PCA which is learned naturally and is more commonly used in daily life. Ultimately, Khamis-Dakwar and Froud (2007) concluded that their findings support a view of these two varieties of Arabic as representing two separate language systems in the brain, despite sociocultural beliefs that they are different registers of the same language (Ferguson, 1959; Eviatar, Zohar & Ibrahim, 2000).

As speakers of one or more language varieties that carry different amounts of prestige and exist within in a single conceptualized system of language, Nonmainstream American English (NMAE) speakers have some commonalities with diglossic language speakers, which therefore suggests that ERP methods used in the previously mentioned study are ideal for the current investigation on NMAE processing (Ogbu, 1999; Willis, 2004). Prior to this experiment, there have been no ERP experiments examining language processing for contrastive morphology or syntax features for any NMAE.

Cross-linguistic processing of phonology has been addressed in previous ERP studies investigating languages with similar phonetic inventories, wherein contrasting phonemes were presented in isolation in an oddball paradigm (Buchwald et al, 1994; Rivera-Gaxiola et al, 2000); however these studies elicited ERPs that appear very early in the processing stream and that did not correlate with later language processing – for example, reduced-amplitude MMN and P300 responses to phoneme contrasts that were not present in merged dialect speakers' productions. In one cross-linguistic study of vowel contrasts presented to native speakers of either Estonian or Finnish (which have similar vowel structures), Näätänen et al (1997) demonstrated that MMN amplitudes in response to non-merged phoneme contrasts were enhanced when the sounds were relevant to the native language (i.e., when Finnish speakers were presented with contrasting phonemes present in Finnish, but not so when presented with contrasting phonemes present in Estonian). This evidence provides some implications for the speech sound processing differences between dialectal language varieties which presumably also have similar phonetic structures. However a crucial difference remains in that unlike bilingual speakers of two similar phonological systems, bidialectal speakers process two varieties that are usually conceptualized as the same language system.

With regard to methodological impacts on language research with EEG, this evidence also demonstrated that in order to elicit late-appearing language processing differences, contrasting words in a dialect needed to be embedded in a sequence (i.e., sentence) and participants had to be required to provide an explicit behavioral response to ensure attentional processing of the stimuli (Conrey, et al., 2005). These findings and recommendations informed the purpose and procedures of the one ERP study found on NMAE dialects, which in turn, impacted the current investigation.

The sole ERP study which investigated NMAE dialects investigated two groups' processing of a vowel merger present in varieties of Southern American English, AAE, and regional dialects of the Southern Midland and Western United States (Labov, 1996). Conrey et al. (2005) examined phonological processing of a non-peripheral front vowel merger before a nasal consonant. Bidialectal speakers of this merged vowel dialect would be perceived by nondialect speakers as producing the words *pin*/*pen* and *main/mine* as homonyms. For merged dialect speakers, the /I/-/ɛ/ and /ej/-/aj/ phonemes are merged as a single phoneme when occurring before a nasal consonant. Nondialect speakers, including those who speak MAE among other NMAEs, would likely perceive dialect speakers' productions of both *pin* and *pen* as "pin." In this experiment, simultaneous auditory and word-by-word text stimuli were presented in sentences to merged and unmerged dialect speakers (e.g., "Sign the check with a /pIn/"). Results demonstrated elicitation of a LPC/P600 in unmerged dialect speakers following the onset of the incongruent target word. In this study, merged dialect speakers also demonstrated reduced behavioral discrimination effects (along with the LPC/P600) in the condition presenting contrasting vowels in words where a critical vowel merger might have been (e.g., when participants read the word *pin* but heard the word/pɛn/). For this task, while merged dialect speakers displayed online sensitivity to violations, they responded at chance level during judgment tasks. The authors concluded that behavioral task demands could cause the observed dissociation (see for a similar argument McLaughlin, Osterhout, & Kim, 2004).

2.6 An ERP Investigation of AAE Language Processing

Conrey et al.'s (2005) finding of LPC/P600 elicitation in response to a shift between merged and unmerged AEs was the closest indicator for the current study's hypothesized P600 response to an online shift between MAE and AAE language varieties. If in the current study – like the language varieties in the aforementioned studies – MAE/AAE bidialectal speakers also demonstrate ERPs associated with switching between systems, it may be inferred that cognitive-linguistic processing is more similar to codeswitching languages than not, at least for morphosyntax. This finding has some major implications for our understanding of bidialectal language development and education.

The section that follows describes how the current study builds on these previous findings to investigate whether AAE morphosyntactic features could also elicit distinct neural responses in bidialectal speakers of AAE-MAE, compared to monodialectal speakers of MAE (hereafter referred to as 'MAE-only' or 'monodialectal'). A description of the target feature in the presented dissertation study is provided, along with a review of sociolinguistic research on the presence of this feature in AAE-speaking communities.

2.6.1 The '-s' marked Verb in African American English.

In this study, the subject-verb agreement –s marker was chosen as the target feature presented in sentence-length stimuli to participants (e.g., *The black cat lap_ the milk)*. This –s marker is a morphosyntactic function because it occurs at the word level, but reflects a sentential syntactic requirement in MAE (agreement between verb and subject). AAE syntax is considered by some linguists as revealing the closest resemblance to African languages and the pidgins and creoles formed following their contact with English in the US in the early 1600s (Dillard, 1972). For example, AAE demonstrates verb constructions with four perfectives, such that aspects of customary action, repetitive action and completion aspects are present, often in the absence of tense markers (Asante, 1990). MAE, by contrast, has only two perfectives, with limited expressions of aspect as the past progressive tense or the simple past tense (Dahl, 1985). This feature of AAE is considered by some scholars to represent the evolution of early contact between American English and the West African languages Efik and Ewe, as a result of the slave trade. These languages contain morphosyntactic features that can be used to express events as having occurred habitually in the present, past or future, thus distinguishing between aspects related to context rather than tense alone.

The –s marker in AAE is a unitary feature, with several grammatical constraints, which stand in linguistic contrast to MAE (Mufwene, Rickford, Bailey & Baugh, 1998; see rows highlighted in yellow in Table 1 above). In AAE, the "-s" marker is omissible across several constructions when speaking grammatically correct AAE, including:

- Plurals (e.g., *two sock_/dog_/kiss_*)
- Possessives (e.g., *Kat_/Juan_/Mitch_ book*)
- Contracted copulas (e.g., *he_ running/she_ running*)
- Present progressive tense verbs (e.g., *she hit_/run_/dodge_*)

Of the '-s' marker omission types, the 3rd person singular present tense is the target stimuli in sentences for the experimental condition (see Chapter 4 and Appendices C and D for stimulus details). AAE speakers have been shown to omit the 3rd person subject-verb agreement marker on a present tense singular verb (e.g., *She hit_/run_/dodge_*) even when speaking to listeners outside of their community, making it a particularly robust and consistent feature of AAE usage across regional populations (Baugh, 1983). It is also a contrastive feature to MAE, in that the 3rd person singular subject-verb agreement is obligatory for typical, monodialectal MAE speakers.

2.6.2 Research on 3rd Person Singular Present Tense Verbs in AAE.

Research on the omission of –s markers can be found across disciplines, as it relates to linguistics, education and speech-language pathology alike. The omission of –s markers from 3rd person singular present tense verbs in AAE was first discussed in Labov's (1968) New York City and Wolfram's (1969) Detroit studies of adult urban Black speakers, which demonstrated a rate of –s marking omission in these sentence types in 56% to 76% of instances, respectively. Across verbal –s contexts, AAE-speaking adults were observed to zero mark verbs over 90% of the time (Labov & Harris, 1986). Studies of typically-developing (TD) language acquisition in AAE-speaking children have also demonstrated–s marker omission in subject-verb agreement situations to be a typical aspect of bidialectal language acquisition. In a study of 400 1st through 5th grade African American children in Michigan, Craig and Washington (2004) found this to be one of the most consistently occurring dialect markers, present in over 50-60% of the children's oral language in a picture description task. Craig and Washington (1994) had previously examined the discourse of 45 African American children in preschool and kindergarten, and found that increased AAE usage was associated with increased syntactic complexity, indicating positive language outcomes with regard to dialect use. Children were divided into high, moderate and low users of AAE syntax features, and subject-verb agreement features of AAE, including the omission of –s on 3rd person singular present tense verbs, were found to occur in 100% of children in the high and moderate use groups, and in 71.4% of the children in the low use group.

In a study comparing the verbal –s productions of typically developing (TD) and specifically language impaired (SLI) children, Cleveland and Oetting (2014) found that TD AAE-speaking children zero marked (i.e., omitted) verbal –s at a rate (22%) that was consistent with that reported in the adult AAE literature by Labov and Harris (1986; 10% to 50%) and Wolfram (1969; 29%). It can be reasonably assumed, then, that the zero marked –s on a present progressive verb is highly prevalent for AAE-speaking children and adults, and is even seen in speakers with lower dialect density in their spoken English. Given the presented evidence, this feature in the experimental stimuli for this project was selected as a practical target for analyzing differences in language processing between MAE and AAE sentences.

2.7 Conclusions: Interdisciplinary Use of Neuroimaging for AAE Research

Investigating the neural mechanisms underlying AAE and MAE proficiency has the potential to resolve some current controversies surrounding the role of AAE in education and may lead to productive connections between the fields of education, speech-language pathology, and neurolinguistics. Using a paradigm previously employed to determine brain-processing differences between languages in bilingual individuals, the presented study explores the neurophysiological differences between processing AAE and MAE grammar in bidialectal and monodialectal individuals. Determining whether these two distinct dialects are processed more like a singular bidialectal language system, or like two distinct systems of linguistic representation, at the level of the brain, is meant to inform views of AAE among educators and SLPs, and perhaps help more researchers see the value of neurolinguistic investigations in minority language groups. Finally, one of the ongoing questions regarding second language acquisition (SLA) concerns whether we learn languages differently as we grow older and if so whether this is due to process-related changes in the brain (e.g., Lenneberg 1967; Stowe & Sabourin, 2005). A programmatic course of research stemming from this initial experiment on the most prominent NMAE group in the U.S. would potentially inform our understanding of SLA across age and dialect groups.

Research questions addressed by this dissertation study, with associated hypotheses and predictions, follow in Chapter 3; and Chapter 4 is comprised of a description of how the two block procedures were built and implemented in the target and control conditions.

3. RESEARCH QUESTIONS AND HYPOTHESES

This research is designed to form the basis for a programmatic course of neurolinguistic study examining non-mainstream American English (NMAE) dialect processing, beginning with African American English (AAE) and Mainstream American English (MAE) comparisons. To this end, questions and hypotheses will explore whether expected event-related potential (ERP) responses for error detection – namely the P600 – will be differentiated across these two language varieties. These neurophysiological indices of error detection in each dialect will also be compared to behavioral responses to grammaticality violations in each dialect. Specific research questions are as follows:

3.1 Research Question 1

Will bidialectal speakers of AAE-MAE demonstrate ERP responses indicating error detection (i.e, P600) to sentences containing a (grammatical) feature of AAE dialect syntax that violates grammatical constraints in MAE?

Hypothesis*:* AAE and MAE constitute distinct linguistic systems in the brain, rather than dialects or registers of the same language.

Based on this hypothesis, it is predicted that bidialectal speakers will not demonstrate a P600 ERP response to sentences containing a feature of AAE dialect morphosyntax (i.e., a violation of MAE-only morphosyntax rules), suggesting this to be an acceptable construction of AAE at the neurocognitive level. Monodialectal MAE speakers, however, are expected to demonstrate a P600 component in response to sentences containing AAE dialect morphosyntax features (in this case, the unmarked 3rd person singular present tense verb, where the –s mark is omitted), since this is a violation of the mainstream dialect.

Rationale: Previous ERP studies investigating differences between dialects have provided evidence of neurophysiological responses to lexical and phonological switches from one language variety to another within sentences, indicating specific processing of codeswitching (Khamis-Dakwar & Froud, 2007; Conrey, et al., 2005; see Chapter 2). Although it remains unclear the extent to which syntactic systems are distinct between languages, the P600 response would be expected only in the case that the AAE grammatical feature (omitted –s marker on a 3rd person singular present tense verb) violates a grammaticality expectation during processing. If the P600 is present, we can conclude that a violation of one grammatical system (MAE) is processed the same way by both monodialectal and bidialectal speakers. If the P600 response is absent for bidialectal speakers, this provides an indication of distinct grammatical processing for MAE and AAE, strengthening the position that these constitute distinct linguistic varieties.

3.2 Research Question 2

Will bidialectal speakers of AAE-MAE provide behavioral grammaticality judgment responses reflective of their neurophysiological responses?

Hypothesis: There is a dissociation between pre-conscious language processing and the metalinguistic perception of ungrammaticality in a low-prestige language variety.

Based on this hypothesis, it is predicted that responses across groups will demonstrate MAE-biased overt judgments of acceptability, such that sentences with AAE morphosyntax features will be labeled as grammatically "unacceptable" (via button press) across groups. For the bidialectal group this means that, despite the previous prediction that bidialectal participants will demonstrate reduced online error detection responses (as reflected by amplitude attenuation of the P600 responses) to sentences containing a morphosyntactic feature of AAE dialect, their behavioral acceptability judgments to those same stimuli will not be significantly different from those of monolingual participants. If evident, this pattern will demonstrate an overt rejection of sentence types that are seemingly acceptable at the neurophysiological level. However, despite the prediction that there will be no significant difference between groups' acceptability responses to AAE morphosyntax features, it is expected that bidialectal participants will respond to trials in the –s marker omitted condition with longer response latency, reflective of increased cognitive load for these decision-making processes.

Rationale: Researchers have reported that dialectal differences in grammar use are generally more discouraged by speakers within the AAE-speaking community, and therefore grammaticality responses to 3rd person present tense verbs with the –s marker omitted, in an educational setting, are expected to be MAE-biased (Adger, Wolfram & Christian, 2007). However, since AAE speakers have been shown to produce 3rd person subject-verb agreements with the –s marker omitted (e.g., *She kick_/run_/dodge_*) even when speaking to listeners outside of their community, it appears that the AAE language variety is accessed as a linguistic system even when metalinguistic knowledge may bias against its use in certain domains. This may increase the difficulty of grammaticality judgments for bidialectal participants, thereby increasing reaction time for decision-making tasks (Baugh, 1983).

4. RESEARCH DESIGN

4.1 Participants

4.1.1 Eligibility and Screening.

Anglo-American Mainstream, monodialectal MAE speakers and African-American, bidialectal AAE-MAE speakers with no known immediate exposure to other dialects or languages were eligible for participation in this study. "Immediate exposure to other dialects or languages" is defined as any exposure to a language variety outside of the target in this study that is spoken in the home and/or was spoken by caretakers during development. All participants were screened to ensure the absence of neurological deficit, hearing differences (i.e., hard of hearing or Deaf) or language impairment.

All volunteers were initially evaluated for inclusion in this study based on a brief 6-point eligibility questionnaire (see section 4.1.2 below) conducted by the principal investigator via email, prior to making an appointment for the EEG recording. Upon arrival at the Neurocognition of Language Lab, a language background questionnaire was administered to obtain demographic information, history of dialect usage and dialect awareness (see Appendix A). Exclusion from participation at any stage would have occurred if potential participants reported a neurological impairment, any immediate family members who speak a foreign language or dialect not part of this study, and any history of learning or language disabilities. All participants who participated in the EEG recording passed all eligibility requirements.

Volunteers were recruited from the tri-state area through advertising at Teachers College, Columbia University and affiliated institutions, word of mouth, and social media postings (e.g., Facebook, online Teachers College, Columbia University message board, CraigsList).

Informed consent was obtained from all participants before study participation. Participants were assured that they could withdraw consent at any time during the duration of the study without penalty. Participants were compensated $30 for travel expenses and time spent, which totaled approximately 1.5-2 hours. All recruitment and consent procedures were carried out with the approval of the Institutional Review Board (IRB) at Teachers College, Columbia University (Protocol #: 16-429, see Appendix E and F). Below are some detailed descriptions of the criteria eligibility items, approved by the IRB at Teachers College.

4.1.2 Brief Eligibility Questionnaire.

Prior to participation, interested volunteers completed a brief eligibility questionnaire via email with the following six questions:

1. Do you have any immediate family members who spoke a language other than English with you during your upbringing?

2. Do you have any fluency in a foreign language?

3. Do you have any of the following: reading/language disorder, hearing loss, other neurological impairment or atypicality (e.g., epilepsy)?

4. Are you ethnically Anglo-American or African-American? If so, which? Also, do you identify with any other ethnic groups?

5. Application of the net requires the participant to have hair that is loose so that a net can be placed on their head, and the electrodes can touch the scalp the whole time. Loose/natural hair is easiest, but if you wear your hair braided, then boxes or rows would work, but not crochet, since the electrodes require access to the scalp all around the head. It really just depends how they're woven in. Would this work for you? If you're unsure, just let me know.

6. Please take this brief (and fun!) quiz and let me know your laterality score and right or left decile to determine your handedness: http://www.brainmapping.org/shared/Edinburgh.php#

These questions were mainly aimed at controlling for a specific dialect, since this study required participants who are MAE monodialectal speakers and AAE-MAE bidialectal speakers. Perceptual studies of American English productive vowel mergers have demonstrated reduced reliability in perceptual distinctions in speakers who do not produce merged phonemes, due to contact with other dialects (Bowie, 2000; Labov, Karan & Miller, 1991). Therefore, interested volunteers who reported immediate long-term exposure to a dialect other than AAE or MAE, including (but not limited to) Appalachian English, Jamaican Patois, or Spanish-Influenced-English, will be excluded from participation in this study, along with speakers who have immediate family members who exposed them to a foreign language from birth (e.g., German, Hebrew, French, etc.).

4.2 Experiment Design

4.2.1 Demographic Background and Language History Questionnaire.

Having passed the initial screening process, eligible participants were provided with an appointment for the EEG recording session. Prior to preparations for net placement, participants completed a more comprehensive language history questionnaire, aimed at classifying specific dialect use and background (see Appendix A). Many studies have used various methods to collect dialect density measures (DDM) for the purpose of categorizing groups by frequency and type of dialect use (Oetting & McDonald, 2002); however these measures were taken primarily from language samples of children among peers in their school environment, which would yield different results from adults in a higher education setting (i.e., the target population for this study). Given the expectation that adult students will speak the more formal MAE variety in higher education settings (i.e., the school domain), a questionnaire was created to obtain information about dialect usage. The questionnaire also collected information about the participants' residential history (i.e., regional American dialect differences), socioeconomic status (i.e., class-related dialect differences), domain usage and exposure (i.e., dialect settings and frequency differences).

It is not uncommon for NMAE speakers to have variable dialect awareness and attempts to establish social differences in language use through self-report are prone to failure for two reasons. In part, this occurs because conscious awareness of actual usages may be inaccessible for many people. In addition, there are documented tendencies for speakers to under-report the use of socially stigmatized language varieties in daily life, and to over-report their use of socially prestigious variants (Labov, 1966; Trudgill, 1972). In children, structured language assessments like the Diagnostic Evaluation of Language Variation (DELV) may be used as a screener for the presence of NMAE features in spoken language; however, these do not specify which variety, are not standardized for adults, and still this measure is susceptible to priming from the administrator and/or domain during testing (Seymour, Roeper, deVilliers, & deVilliers, 2003). In other studies, informal language samples were collected and dialect density markers (DDM) were measured as a method for determining dialect feature frequency. However, the language sample itself is susceptible to the same influences mentioned previously. Hence, despite the limitations of self-report in adults, self-report questionnaires are still a frequently used method of classifying AAE dialect users (Oetting & McDonald, 2002). In this study, the qualifying group was also controlled for African-American ethnicity alone and language exposure from immediate family, thereby limiting variation and excluding other language or dialect influence.

4.2.2 Investigational and Control Experiment Design.

The current study investigated the effects of two different dialect groups and four sentence types on participants' ERP and behavioral responses. This was devised as one experiment, with four conditions, presented in two blocks, with a 2 x 2 balanced factorial design for the comparison of responses in each. Factors were *Spoken Dialect* with *Monodialectal* and *Bidialectal* groups, and 4 levels of *Sentence Type,* which were subdivided into 2 blocks. Sentence types (i.e., conditions) 1 and 2 were presented as Block 1 and investigated the manipulation of the *3rd Person –s Marked* and *3rd Person –s Omitted* condition, respectively. Sentence types 3 and 4 were presented as Block 2 and investigated the manipulation of the *Accusative Pronoun-Verb Agreement* and the *Nominative Pronoun-Verb Disagreement*, respectively. See Table 3 below.

Blocks 1 and 2 collectively represented the four conditions of varying grammaticality presented across these two groups, from which both ERP and behavioral data were collected. ERP neurophysiological responses were collected pre-attentionally, while participants listened to sentences. Sentence acceptability judgments were collected via button press, immediately after each auditory trial (see section 4.2.3 Trial Design). Traditional measures of accuracy in this experiment apply across groups to Block 2 alone, since sentence types 3 and 4 present a shared grammar. For Block 1, acceptability responses were collected and are discussed with regard to percentage of MAE-biased responses in the bidialectal group, rather than "accuracy." Reaction time was also measured and reported, and time-outs occurring after 3000ms were counted as *no response* items; time-out trials were omitted from behavioral data analysis but retained for ERP analysis.

While Block 1 consisted of sentence types 1 and 2, and represented the experimental target of this investigation, Block 2 (sentence types 3 and 4) constituted a set of control conditions so that comparisons could be made between groups' neurophysiological and behavioral responses to sentences where syntax rules were mutually violated. This comparison allowed for a consideration of whether markers of linguistic processing are different across shared grammatical rules, and along what parameters (e.g., latency, amplitude and/or localization of the component). To compare group responses to a shared grammatical violation, the accusative case (i.e., objective pronoun-verb) agreement obligation was chosen (e.g., *The angry husband avoids her/she at the party*). While not central to this dissertation investigation, predictions for these control conditions were as follows:

1. While processing auditory sentences containing a shared morphosyntax rule violation, monodialectal and bidialectal speakers were expected to demonstrate similar ERP responses indicating repair and reanalysis (i.e, P600), without significant differences in component latency, amplitude and localization.

2. After being presented with sentences containing a shared morphosyntax rule violation, monodialectal and bidialectal speakers were expected to demonstrate similar grammaticality judgment responses, without significant differences in accuracy or response time.

Table 3: *Condition and Group Design*

Sentence Types			Groups: Monodialectal Speakers	Groups: Bidialectal Speakers
	1	**3rd Person -S Marked** Ex. *The black cat laps the milk.*	Acceptable	Acceptable
	2	**3rd Person –S Omitted** Ex. *The black cat lap_ the milk.*	Not Acceptable (P600 predicted)	Acceptable* (MAE-biased grammaticality judgment predicted)
	3	**Accusative Case (Agreement)** Ex. *The gentle doctor comforts them in the clinic.*	Acceptable	Acceptable
	4	**Nominative Case (Disagreement)** Ex. *The gentle doctor comforts they in the clinic.*	Not Acceptable (P600 predicted)	Not Acceptable (P600 predicted)

Note. Inside each box is stated the acceptability of the morphosyntax feature in the given dialect (not the predicted behavioral response). Only in the *not acceptable* condition is the P600 component response predicted. *Asterisk indicates the condition where it was predicted that the bidialectal group would provide MAE-biased behavioral responses to the heard sentences (i.e., *not acceptable*) despite it being an AAE feature that is expected to be associated with reduced indices of violation detection at the neurophysiological level (i.e., P600). In the Nominative Pronoun Verb Disagreement condition – which is *not acceptable* across dialects – the P600 component response was predicted to be elicited for both groups. Grammaticality judgments were expected to be similar across conditions, since this is a shared rule violation in both language varieties.

4.2.3 Trial Design.

As aforementioned, the current dissertation study consisted of two blocks, each with two conditions. In Block 1, a total of 84 sentences were presented, 21 in each of two conditions, presented twice in alternating blocks (i.e., 21 x 2 x 2). Each condition contained a sentence with an identical counterpart, differentiated only by the use or absence of the '-s' marker on the verb.

In Block 2, a total of 132 sentences were presented, 33 in each of two conditions, presented twice in alternating blocks (i.e., 33 x 2 x 2). Each condition contained a sentence with an identical counterpart, differentiated only by the pronoun type.

All stimuli were created using natural speech recordings, from a 36-year-old, White, female, voice-over professional. The recording artist is a bidialectal speaker of MAE and Southern American English, which has well-documented feature overlap with African American English. In recording the stimuli, the speaker was instructed to read lists of words by grammatical category with monopitch and monotone speech production. Stimuli were thus recorded as lists of single words (thereby controlling for effects of intonation and inflection), subsequently cut and arranged into sentences with one-word-per-second presentation. The difference between words was spliced with intervals of silence using Praat v5.3.2 software (Boersma & Weenink, 2005; Wood, 2005). The intensities of all the stimuli were set to 70 dB SPL using Audacity software (Mazzoni, 2008) and verified to be 70 dB SPL on the stimulus presentation computer using a sound pressure level meter. See Figure 3 below for a depiction of experimental stimuli production, including timing of trial onset for Block 1, and see Appendices C and D for a complete list of sentence stimuli across both blocks.

In Condition 1, the onset of the '-s' marker on target words was set to be consistently voiceless /s/, following a voiceless plosive consonant /s/, /k/ or /t/ (e.g., barks, bats, keeps). Sentence-length stimuli consisted of six monosyllabic words, and followed a syntax pattern of 'The' + [adjective modifier] + [animate noun] + [present tense verb] + 'the' + [inanimate noun] (e.g., *The stray cat laps the milk*). Sentences in Conditions 1 and 2 were identical recordings, with the '-s' phoneme manually removed in Condition 2 stimuli (e.g., *The stray cat lap_ the milk*), therefore each trial served as its own control for lexical frequency and other psycholinguistic factors across conditions. All sentences in Conditions 1 and 2 were six seconds long.

In Condition 3, the onset of the target pronoun followed a regular present tense continuous verb with an '-s' marker (e.g., annoys, admits), expressed as /s/ or /z/ (i.e., voiced or voiceless). Sentence-length stimuli for Condition 3 consisted of eight words where all content words were bisyllabic and followed a syntax pattern of 'The' + [adjective modifier] + [animate noun] + [present tense verb] + [pronoun] + [preposition] + 'the' + [inanimate noun] (e.g., *The eager puppy follows us to the kitchen*). Target pronouns in the agreement condition included *them*, *us*, *him* and *her*, and with counterparts in the non-agreement condition being *they*, *we*, *he* and *she*, respectively. Target pronouns *them/they* and *her/she* occured nine times in each condition, *him/he* occured ten times in each condition and *us/we* occured five times in each condition. Sentences in Conditions 3 and 4 were identical recordings, with only the pronoun swapped in Condition 4 stimuli (e.g., *The eager puppy follows* *we* *to the kitchen*). All sentences in Conditions 3 and 4 were eight seconds long.

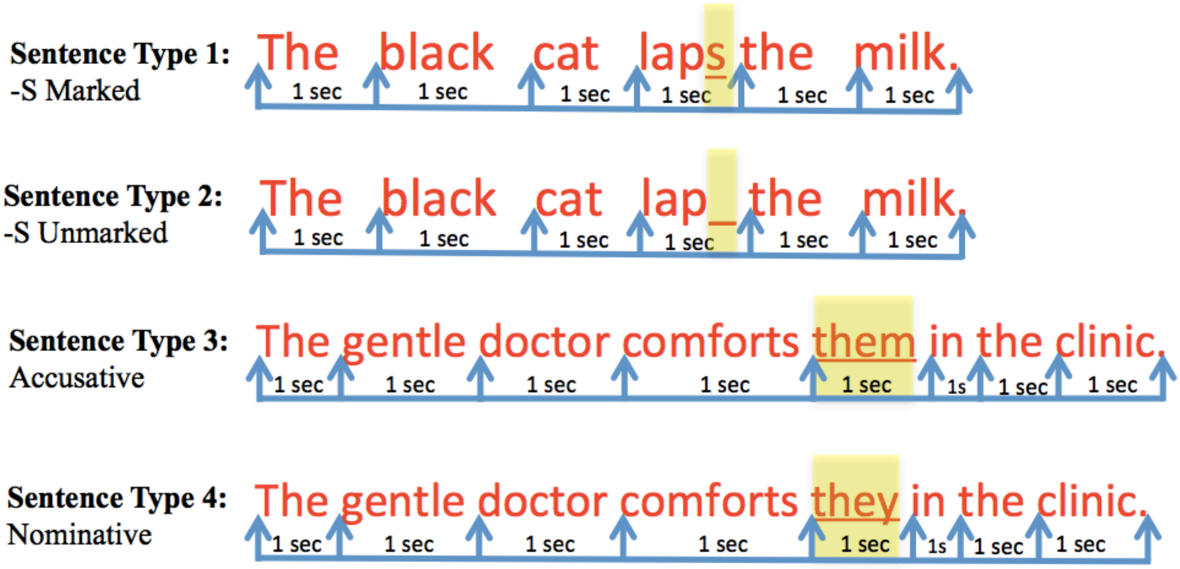


Figure 3. *Sample stimulus design for Blocks 1 and 2.* Each word's onset in the sentence occurred at the 1-second interval. EEG recording was continuous, but ERPs were segmented from within a time-locked window during the presentation of the end of the target word in Block 1 (e.g., *lap/_* or *lap/s*) and the beginning of the target word in Block 2 (e.g., */he*r or */she*).

4.3 Methods

4.3.1 EEG Methods and Specific Parameters.

Electroencephalography (EEG) is a technique for recording the electrical activity generated by large populations of neurons, particularly pyramidal cells and thalamo-cortical circuitry, which has a parallel and orthogonal path of activation within the cortex (Öllinger, 2009; also see section 2.5 in chapter 2 above: *An introduction to EEG and evoked-response potentials*).

All EEG recordings were carried out in the Neurocognition of Language Lab at Teachers College, Columbia University. The lab uses equipment supplied by Electrical Geodesics, Inc. (www.egi.com), and data in this experiment were collected via 128-channel geodesic sensor nets, which hold an arrangement of equally distributed electrodes in relative positions to each other with fine elastic (referred to as a geodesic arrangement: Tucker, 1993). The electrodes are embedded in sponges, which are soaked in an electrolyte solution and placed on the participant's head. The electrodes record neurophysiological signals (voltage fluctuations generated by summed post-synaptic potentials, largely from thalamo-cortical circuits) at the scalp, with high temporal resolution (millisecond recordings are possible). Electrical Geodesics Incorporated (EGI) Netstation (v4.5.6) data acquisition software was used to record the continuous EEG with a sampling rate of 250 Hz (i.e., one sample every 4ms). In order to prevent antialiasing of the signal, the raw EEG data were filtered using an analog, 0.3 – 30 Hz low-pass filter determined based on the Nyquist frequency of the sampling rate, prior to digitization (filter settings for FIR Passband Gain: 99.0 % (-0.1 dB); Stopband Gain: 1.0 % (-40.0 dB); Rolloff: 2.00 Hz).

Electrical source localization can also be measured using EEG, with research demonstrating that 64 to 128 channel nets are capable of providing localization ranging from hemispheric exactitude to within 15-20mm of a localized source (Luu, Tucker, Englander, Lockfeld, Lutsep & Oken, 2001; Lantz, Grave, Spinelli, Seeck & Michel, 2003; Song, Davey, Poulsen, Luu, Turovets, Anderson, Lee & Tucker, 2015). Source localization with new EEG methodology is now capable of addressing the well-known issues of distortion from varying impedances between electrodes, scalp, skull, meninges and brain tissue to provide estimated solutions to the inverse problem (Pizzagalli, 2007). However, source localization is not a question for this study at the present time, since the outcome measure of interest is the P600, which can be characterized temporally rather than in terms of its localization (it is known to have multiple generators, resulting in a broadly posterior presentation across groups of electrodes) (Nakagome, et al, 2001).

When placed on the scalp, the sensor net is connected to an amplifier (EGI Net Amps 300), which is capable of recording very small electrical signals generated by brain activity, so that by time-locking to a specific stimulus (i.e., event), it is possible to retrieve event related potentials (ERPs) from the EEG recordings. This is achieved by presentation of the same event over multiple trials, which are recorded, segmented and averaged across multiple trials (Rugg & Coles, 1995). Sensor nets were checked and calibrated at the start of each participant run, and impedances were measured to determine the amount of signal loss between scalp and electrodes. During this measure, electrodes were adjusted and rehydrated so that impedances did not exceed 40kΩ. In order to sustain the integrity of the recording throughout the experiment, impedances were reassessed between blocks and electrodes were rehydrated with potassium chloride solution as needed. During data recording, the participant and electrode impedances were monitored, with bad channels and artifacts noted so that those channels and/or trials could be removed from analysis during offline processing of the data.

During collection of the EEG data, participants were seated approximately 80cm in front of a computer screen in a sound-attenuated and electrically shielded room. Auditory stimuli were played free field, directly overhead (described more fully below), and participants were asked to listen to recorded sentences and to press one of two buttons to indicate whether they found each sentence “acceptable” or “unacceptable”. Stimuli were presented at 70-decibel (dB) sound pressure level (SPL), and a sound pressure level meter was used to verify intensity in the experiment room. Behavioral responses were elicited (via button press to indicate a binary choice) from participants for each sentence, both to maintain attention and for comparative data analyses between and within groups with regard to MAE-biased or NMAE-inclusive responses and response latencies between conditions. Note that accuracy per se is not a measure in this study, since judgments of the acceptability of these sentences will vary between individuals depending on the extent of their bias toward MAE forms. Therefore any implicit priming that may occur due to the lab domain and interactions with experimenters is described as a contributing factor in the discussion of results (see Chapter 5).

Once recorded, EEG data must undergo preprocessing, including filtering, segmentation, artifact removal, and baseline correction. Following this, the data are analyzed according to a pre-established time window and region of interest (i.e., an electrode montage) for each ERP component targeted. Specifically, the ERP component examined in this inquiry is the P600, a posterior ERP typically observed over centro-parietal sensors, associated with syntactic errors within a language (see Chapter 2 for background).

4.3.2 Stimulus presentation.

All stimuli were presented auditorily, via a single, free-field, Tannoy OCV 6 full-bandwidth speaker centered 193 cm above the participant’s chair. Recorded natural-speech sentence conditions were presented in randomized order, without immediate repetitions; however, each stimulus sentence was presented twice, to increase the likelihood of acceptable trials (i.e., trials without artifact) and the statistical power, given the limited number of producible stimuli. See Figure 4 below for a graphical representation of the sequence of events during experimental tasks across experiments. Interstimulus interval (ISI) between sentences varied according to participant response rate, since each trial proceeded immediately after a grammaticality judgment response was collected on the previous trial. ISI therefore varied up to a maximum of 3000ms response latency, after which the next trial was automatically presented. After 3000ms, trials timed out and were recorded as *no response.*

Participants whose *no response* rate exceeded 50% were eliminated from ERP and behavioral analysis. Since behavioral responses were elicited 2000ms past the expected ERP time-window, trials with *no response* remained in the ERP analysis but were excluded from behavioral analysis for grammaticality judgment. Auditory stimuli were presented using Eprime version 2.0.8.90 (Psychology Software Tools Incorporated, Pittsburgh, Pennsylvania).

At the start of the block, participants read instructions onscreen, requesting that they watch the cross hair (e.g., +) while listening to sentences, then at the question mark sign, to press button 1 to indicate a judgment of *acceptable* and button 2 to indicate *unacceptable* using a Serial Response Tool (Psychology Software Tools Incorporated, Pittsburgh, Pennsylvania). Following this, participants completed four practice trials (2 in each condition) in order to familiarize them with the experimental protocol and ensure their comfort and cooperation.

Figure 4. *Sentence presentation.* Participants were asked to fixate their gaze on the crosshair while listening to sentences, and to perform grammaticality judgments when they saw the question mark**.**

4.3.3 Sample size and power calculations.

Estimations of power and appropriate sample size for ERP are notoriously difficult (see, Picton et al., 2000 for an overview of some of the issues involved in statistical approaches to analyzing data from neuroimaging experiments). Power estimation requires knowledge of the expected percent signal change between two conditions (effect size), as well as estimates of the variability in signal change, and these are usually unknown in brain imaging studies. Signal-to-noise is typically low, due to repeated presentations of stimuli within each condition while EEG data are recorded from participants over a period of time. The experiment performed here required approximately 40 minutes of EEG recording time total (9-11 minutes each over 2 blocks, repeated once and not including breaks, during which there is no recording). The raw data consisted of continuous digital recordings (sampling at

250 times per second) of voltage deflections at 128 different points on each participant's scalp. This means that, for this ERP experiment, a time series of approximately 135,000 (i.e., 250 samples per second x 60 seconds per minute x 9 minutes per block) data points for Block 1 and approximately 165,000 (i.e., 250 samples per second x 60 seconds per minute x 11 minutes per block) data points for Block 2, for each of the 128 sensors for each experiment, for each participant were captured. Block 2 is slightly longer than Block 1 due to increased length of bisyllabic words in the sentences compared to Block 1. Within the time series data, there are two sources of variability of interest: within-subject time course variability (i.e., fluctuations from one time point to another) and within-subject experimental variability (i.e., variation in the effectiveness of the experimental conditions at producing a percentage signal change). As a result, analyses of power and sample size for brain imaging data are complex, and little work has been done on generation of power curves for ERP. Sample sizes and numbers of trials per condition have therefore been established with reference to available guidelines (e.g., Picton et al., 2000; Handy, 2005; Luck, 2005) and the previous experimental experiences of the sponsor.

This ERP study addressed the component known as the P600, which has been shown to index language related difference detection, including syntactic error (see Chapter 2 for background; for a review see Kaan, 2007). Most studies of bilingual language processing which investigate this component have included between 11 and 15 participants in the experimental group (Proverbio, et al., 2004; Rodriguez-Fornells, et al., 2002; Leikin, 2008; Kotz, et al., 2008; also see Moreno, Rodríguez-Fornells & Laine, 2008 for a review). In reviewing the literature, only one study using ERP measures to examine bidialectal American English (AE) speaking groups emerged (Conrey, et al. 2005). That study investigated participants' phonological processing of a merged vowel present in Southern American English which is not merged in Mainstream American English (e.g., *pin/pen* would be produced similarly in the Southern American English variety), and analyzed a total of 22 participants' data (n =11 in each group). No studies were found which investigated American English dialect morphosyntactic processing and specifically, no studies exist which have applied EEG methodology to the investigation of AAE processing. Hence, by recruiting 30 participants for the proposed study (15 per group), the sample size for this study meets the upper average recruitment and analysis sample for current research in this field.

Stimuli in comparable studies of sentence processing investigating P600 elicitation have presented an average of 25-30 sentences per condition, when controlling for content word frequency across specific sentence frames (e.g., Hagoort et al., 1993; Neville, Nicol, Barss, Forster & Garrett, 1991; Moreno, Bialystok, Wodniecka, Alain, 2010; Leikin, 2008). In other studies, where a smaller set of target words were controlled for frequency and repeated across a greater number of variable sentence frames, stimuli ranged from 80 to 120 per condition (e.g., Moreno, et al., 2002; Khamis-Dakwar & Froud, 2005; Kotz, Holcomb, & Osterhout, 2008; Conrey, et al., 2005). The current study controlled for lexical frequency and length of all content words, including verbs, nouns and adverbs, set into specific sentence frames, while also controlling for phonemic and phonotactic characteristics of the –s marker (i.e., /s/ or /z/, occurring only after a plosive consonant). Therefore the given number of stimuli (24 sentences per condition) is within the average range for the level of control in this study. To increase the numbers of trials and enhance power in the EEG data set, each block of 24 sentences was presented twice (in alternating blocks), totaling 48 trials per condition; this number exceeds the average sample for current research investigating this ERP component.

4.3.4 Participant debriefing.

At the conclusion of the experiment session, each participant was debriefed to gain insight into how participants interpreted the task. Subjective reports on participants' strategies during experimental tasks, combined with behavioral and ERP analyses, provide information that could assist in deriving conclusions from results (Picton, et al, 2000). For example, since participants were not overtly informed of the specific dialect which this study investigated, reports after participation on how they interpreted stimuli during the experiment provided some information on participants' metalinguistic awareness of language variation. Such insights could have an effect on ERP and/or behavioral outcomes, and provided additional insights for further investigation. See Appendix B for a list of questions that were used during debriefing.

4.4 Experimental Procedure

Participation in the experiment involved completion of the Brief Eligibility Questionnaire and one visit to the lab.

<u>Experimental Protocol</u>

1. PI familiarized participants with the lab equipment and procedures. Questions were encouraged and answered throughout the laboratory introduction.
2. Participants were presented with a consent form and asked to read it carefully. Risks were explained fully and any questions were answered before the participant signed

the form. The participant was reminded that they could withdraw participation at any time.

3. Following signed completion of the consent form, participants completed the *Demographic & Language Background Questionnaire* (see Appendix A).
4. The head circumference of each participant was measured and the appropriately-sized sensor net selected. The researcher measured the vertex of the head in order to properly position net electrodes.
5. The participant was fitted with an appropriate 128-channel HydroCel Geodesic Sensor Net (HCGSN) (Net Amps 300, Electric Geodesics Inc., Eugene, OR). Electrodes were positioned with reference to the vertex marking made previously on the participant's scalp.
6. The participant was seated in a chair approximately 80cm from the computer monitor in a sound attenuated and electrically shielded chamber within the Neurocognition of Language Lab. Sounds were presented in free field. A video camera provided visual information about the participant during the experiment. The amplifier was checked and calibrated, the net was connected and impedances were measured. In order to improve impedances the electrodes were adjusted as necessary.
7. Experimental EEG tasks were presented in four blocks of 9-11 minutes each to minimize fatigue. Between blocks, participants were encouraged to take short breaks, as impedances were re-checked and electrodes adjusted as needed.
8. Following completion of the EEG experiment, the sensor net was removed and participants were debriefed. The whole experiment lasted 1.5 to 2 hours total for each participant.

4.5 Data Analysis

4.5.1 Data pre-processing.

A standard ERP analysis protocol was used for processing the EEG data (following principles described in detail in Picton et al., 2000; Luck, 2005; Handy, 2005). Raw EEG recordings were digitally filtered offline using a 30 Hz LowPass filter and .3Hz HighPass filter (FIR Passband Gain: 99.0 % (-0.1 dB); Stopband Gain: 1.0 % (-40.0 dB); Rolloff: 2.00 Hz), and then subjected to automatic and manual artifact rejection protocols for removal of movement and physiological artifacts (electrocardiogram, electromyography, electrooculography). Eye channels and noisy channels were marked as bad, and interpolated using spherical spline interpolation based on recorded data from surrounding sensors. Data were re-referenced offline to an average reference to eliminate the influence of an arbitrary recording reference channel. Average referencing eliminates the influence of an arbitrary recording reference (the vertex channel in this case), and allows the inclusion of the vertex, while allowing for a better approximation of ideal zero reference values (electrical potentials summed across the whole head average to zero: Handy, 2005). The continuous recordings were segmented into 1200 millisecond epochs, including 100ms pre-stimulus onset (baseline) and 1100ms following the onset of target stimuli (i.e., the word or –s marker onset). A time window of 500-800ms post stimulus onset was targeted for identification of the P600 ERP component.

Segments were averaged together to increase the signal-to-noise ratio, and to identify time-locked event-related responses associated with the onset of the target auditory stimulus presentation within the sentence. EEG epochs were averaged separately for each of the four grammaticality conditions, for each individual participant. The average waveforms were baseline-corrected, a procedure that involves subtracting the average electrical potential during the 100ms baseline period from the epoch of interest in order to bring the recording closer to zero, further enhancing the signal-to-noise ratio by removing baseline activity and controlling for artifacts such as amplifier drift.

Analyses were constrained to a montage of electrodes that are of interest in the current study. Auditory P600 signals have been shown to have multiple generators and are maximally recorded at centroparietal electrodes (Luck, 2005; Handy, 2005). Channels for the P600 montage were selected for this study based on prior research investigating the P600 component in American English dialects and included electrodes 52, 53, 54, 59, 60, 61, 66, 67, 72, 77, 78, 79, 80, 85, 86, 87, 92, 93 in the 128-channel geodesic sensor net by EGI (see section 4.3; Conrey, et al., 2005). See Figure 5 below for a map of the selected montage.

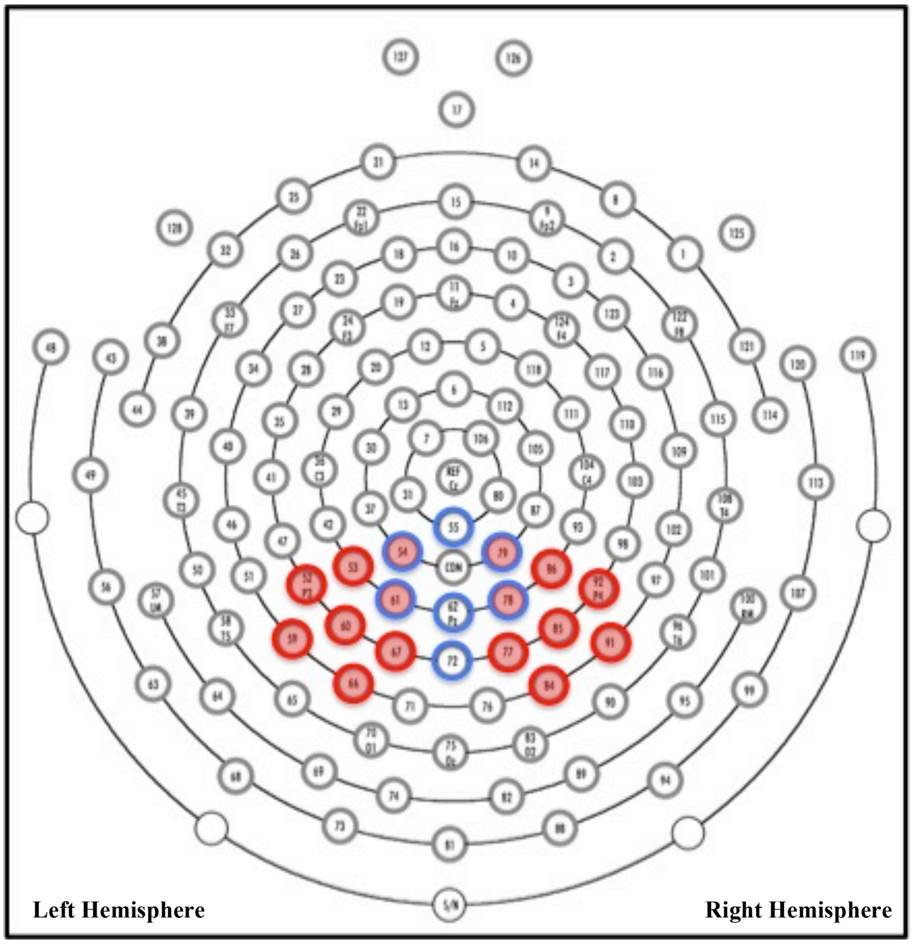


Figure 5. *P600 Montage.* Blue outlined electrodes were selected for the P600 montage analysis. Red shaded electrodes in separate groups demonstrate left and right montages for laterality comparisons of the P600 montage.

4.5.2 Data analysis protocol.

After pre-processing in NetStation, the segmented and averaged EEG data were exported for statistical analyses using R Studio (v3.2.2) data analysis packages. Repeated measures analyses of variance (ANOVAs) were conducted to test for main effects and interactions in the data (cf. Dien & Santuzzi, 2005). Data were analyzed between conditions in Block 1 (*Sentence Types 1* and *2*) and Block 2 (*Sentence Types 3* and *4*), as well as between groups (*Monodialectal* and *Bidialectal*) to determine whether there were significant differences in mean P600 amplitude. The ANOVAs were followed by planned comparisons (paired samples and independent samples t-tests) at each level of each significant variable, in order to determine the sources of significant main effects and interactions.

Behavioral data (acceptability judgments and reaction times) were analyzed for proportion of MAE-biased responses in Conditions 1 and 2, and proportion of correct responses in Conditions 3 and 4 across both groups, using a repeated measures ANOVA with a within groups factor of Sentence Type and a between groups factor of Dialect for each of Block 1 and Block 2. Response times (RTs) were analyzed using t-tests, after timed out responses (i.e., *no response* types) were removed.

Post hoc methods were also used to investigate further results of interest in this line of research, in order to address secondary questions. For example, some research demonstrates that bilingual speakers have more equivalent mean amplitudes between hemispheres compared to monolingual speakers, who may show greater left-side lateralization (Proverbio, Leoni, & Zani, 2004). Therefore laterality comparisons were performed within and across dialectal groups in order to shed light on whether hemispheric patterns of mean P600 amplitude in bidialectal speakers reflect those previously seen in monolingual speakers or bilingual speakers.

The current dissertation study was conducted using the experimental procedures described here, with data collected from 30 participants. In the next chapter, results of the experiment are detailed, before a summary of the findings and ideas for future directions.

5. RESULTS

The following participants and resulting behavioral and neurophysiological outcomes were obtained using methods previously described in Chapter 4. Results and conclusions, with discussion of limitations and future directions for a programmatic line of research in this vein, complete this dissertation.

5.1 Participants

A total of 43 adults were recruited for participation in this study, with thirty participants included in the analyses described below (criteria described in Chapter 4, Section 4.1.1). Informed consent was obtained from all participating volunteers. Volunteers were recruited through bulletin board advertising at Teachers College, Columbia University, word of mouth and social media postings (e.g., online message boards). Participants were assured that they could withdraw assent at any time during the duration of the study without penalty. Participants were provided $30 compensation for participating. Compensation was paid for by a Teachers College, Columbia University Vice President's Student Research in Diversity grant that was awarded to this study in 2011.

Of the 43 recruited participants, 23 were bidialectal (AAE-MAE) American English speakers and 20 were monodialectal (MAE) American English speakers. From this total, six monodialectal participants and 4 bidialectal participants were omitted from analysis in this study due to either receiving half the number of trials as presented to other participants (i.e., a different procedure), or due to having some disqualifying difference reported in their questionnaire responses on the day of the study. An additional two monodialectal participants cancelled prior to the experiment run, and another one of the recruited bidialectal participants was not run secondary to net application difficulty. Thus, a total of 30 participants (15 monodialectal, 15 bidialectal) were included in either one or both of the following ERP and behavioral experiments in this study. Some participants' data were excluded from one or both of these pilot analyses for reasons described below.

5.1.1 Participant Inclusion.

In the ERP analysis, 27 total participants were included. In the bidialectal group, this meant the inclusion of 14 participants with reported exposure to MAE and AAE in home and community domains, aged 22-47 years (*M*=29.8, *SD*=8.2), including 10 females and 4 males, 1 of which were reportedly left-hand dominant. In the monodialectal group, this meant the inclusion of 13 participants with reported exposure to predominantly MAE in home and community domains, aged 22-43 years (*M*=28.6, *SD*=5.8), including 7 females and 6 males, 2 of which were reportedly left-hand dominant. Those participants who were included in behavioral analyses but removed from EEG analyses were omitted due to increased noise artifact that resulted in fewer than 50% usable trials. This resulted in the inclusion of 3 participants' data (1 bidialectal and 2 monodialectal) in the behavioral analysis that was not included in the ERP data analysis.

In the behavioral analysis, 28 total participants were included. In the bidialectal group, this meant the inclusion of 13 participants with reported exposure to MAE and AAE in home and community domains, aged 22-47 years (*M*=30.1, *SD*=9.4), including 10 females and 3 males, all right-hand dominant (per self report). In the monodialectal group, this meant the inclusion of 15 participants with reported exposure to predominantly MAE in home and community domains, aged 22-43 (*M*=28.9, *SD*=5.4), including 8 females and 7 males, 2 of whom were reportedly left-hand dominant.

Participants were omitted from the behavioral analysis if they demonstrated a *no response* rate during the grammaticality judgment task exceeding 50%. Since evidence from behavioral analysis will inform secondary questions in this study and is not being correlated to neurophysiological responses, removal from behavioral analysis did not necessitate removal from ERP analysis for these participants. Please see Table 4 for a breakdown of final participant inclusion after post-processing. Across tasks, 30 different participants were included the analyses: 25 in the behavioral and the ERP analysis, 28 in the behavioral analysis only, and 27 in the ERP analysis only.

Table 4: *Numbers of Participants in Each Group, Block, and Task*

Group	**Participant Number**			
	ERP Blocks		**Grammaticality Judgment Task**	
	Block 1	**Block 2**	**Block 1**	**Block 2**
Bidialectal (AAE-MAE)	14	14	13	13
Monodialectal (MAE)	13	13	15	14

5.2 Demographic Background & Language History Questionnaire.

Of the 30 participants included in the ERP and/or behavioral analyses for this study, 29 provided a complete a demographic & language background questionnaire, which underwent edits for precision of language one time during the piloting process. The full version can be found in Appendix A.

The obtained demographic information is presented below in Tables 5 and 6 for the bidialectal group and Tables 7 and 8 for the monodialectal group. Information in these tables has been streamlined to match updated response categories for socioeceonomic status in the final questionnaire. For example, if participants originally chose 'low' as their socioeceonomic status / income category in the pilot version of the questionnaire, they were assigned to 'Poverty or Working Class' in the chart below, as would have been selected on the final questionnaire for this dissertation study. If participants chose 'middle,' they were re-assigned to 'Lower/Mid/Upper Middle' SES; if they chose high, they were re-assigned to ‘Upper Middle or Upper,’ unless otherwise specified. Hence, the final version of the demographic questionnaire classifies socioeconomic groups more specifically, according to U.S. census classifications for income (Proctor, Semega & Kollar, 2016).

Table 5: *Demographic Data – Bidialectal Group*

	Sex	Handedness	Age	Race	Ethnicity	Childhood SES	Education	Occupation
1	Female	Right	47	Black	Af. Am.	Poverty or Working Class	M	Graduate Student
2	Female	Left	34	Black	Af. Am.	Lower/Mid/Upper Middle	B	Receptionist
3	Female	Right	22	Black	Af. Am.	Poverty or Working Class	B	Graduate Student
4	Female	Right	23	Black	Af. Am.	Middle	B	Graduate Student
5	Female	Right	23	Black	Af. Am.	Lower/Mid/Upper Middle	B	Graduate Student
6	Female	Right	25	Black	Af. Am.	Poverty or Working Class	B	Animal Control Specialist
7	Female	Right	27	Black	Af. Am.	Lower/Mid/Upper Middle	B	Graduate Student
8	Male	Right	25	Black	Af. Am.	Poverty or Working Class	A	College Student
9	Male	Right	44	Black	Af. Am.	Lower/Mid/Upper Middle	B	Unemployed
10	Male	Right	22	Black	Af. Am.	Lower/Mid/Upper Middle	B	Graduate Student
11	Male	Right	33	Black	Af. Am.	Upper Middle/Upper	B	Digital Media Technician
12	Female	Right	30	Black	Af. Am.	Middle	B	Journalist
13	Female	Right	24	Black	Af. Am.	Working Class	M	Graduate Student
14	Female	Right	46	Black	Af. Am.	Middle	M	Researcher
15	Female	Right	22	Black	Af. Am.	Middle	M	Graduate Student

Legend
A=Associate's degree
B=Bachelor's degree
M=Master's degree

Table 6: *Language Background Data – Bidialectal Group*

	Childhood City	English Dialect Exposure	Foreign Language Exposure in Community
1	Dallas, TX	AAE, MAE, SIE	Spanish, French, German
2	NYC, NY	AAE, MAE, SE	None specifically
3	Washington, DC	AAE, MAE, SIE	None specifically
4	San Diego, CA	AAE, MAE, SE, SIE	Spanish
5	West Bank, New Orleans, LA	AAE, MAE, SE	None specifically
6	Westhampten, NJ / Atlanta, GA	AAE, MAE, SE, CAE, CE, SIE	None specifically
7	Brooklyn, NY / Newark, NJ	AAE, MAE, SE	Spanish
8	Richmond VA / Brooklyn, NY	AAE, MAE, SE	Spanish, Russian, Polish, Hebrew
9	Brooklyn, NY	AAE, MAE, SE, SIE, Miami English	None specifically
10	Islip, NY	AAE, MAE	Spanish, Italian
11	Miami, FL	MAE, AAE, SE	Spanish
12	Detroit, MI	AAE, MAE, SE, CE	Spanish
13	Charlotte, NC	AAE, MAE, SE	None specifically
14	Washington, DC	None specifically	None specifically
15	Oakland, CA	None specifically	None specifically

Legend
MAE=Mainstream American English, AAE=African American English, SE=Southern English CE=Canadian English, CAE=Chicano American English (Mexican English), SIE=Spanish Influenced English, AE=Appalachian English, O=Other

Table 7: *Demographic Data – Monodialectal Group*

	Sex	Handedness	Age	Race	Ethnicity	Childhood SES	Education	Occupation
1	Female	Right	29	White	Ang. Am	Upper Middle or Upper	M	Graduate Student
2	Female	Right	23	White	Ang. Am	Upper Middle or Upper	B	Graduate Student
3	Female	Right	27	White	Ang. Am	Upper Middle or Upper	M	Graduate Student
4	Male	Left	33	White	Ang. Am	Lower/Mid/Upper Middle	M	Graduate Student
5	Female	Right	22	White	Ang. Am	Lower/Mid/Upper Middle	B	Graduate Student
6	Female	Right	23	White	Ang. Am	No info.	No info.	No info.
7	Female	Right	25	White	Ang. Am	Upper Middle or Upper	B	Graduate Student
8	Male	Right	29	White	Ang. Am	Lower/Mid/Upper Middle	M	Freelancer
9	Male	Right	33	White	Ang. Am	Lower/Mid/Upper Middle	M	Teacher
10	Male	Right	43	White	Ang. Am	Lower/Mid/Upper Middle	M	Computer Support Tech.
11	Male	Right	32	White	Ang. Am	Middle	B	CNC Operator
12	Male	Right	33	White	Ang. Am	Lower/Middle	B	Housing Coordinator
13	Female	Right	27	White	Ang. Am	Middle	M	No Response
14	Male	Left	25	White	Ang. Am	Middle	M	Technical Writer
15	Female	Right	29	White	Ang. Am	Upper Middle	M	Doctoral Student

Legend
A=Associate's degree
B=Bachelor's degree
M=Master's degree

Table 8: *Language Background Data – Bidialectal Group*

	Childhood City	English Dialect Exposure	Foreign Language Exposure in Community
1	Weston, CT	MAE	Some Spanish
2	Birmingham, AL	MAE, SE	Some Hebrew, German; no spoken skills.
3	Topeka, KS / NYC, NY	MAE, SE, AAE, MAE	Basic Spanish skills
4	Wausaw, WI	MAE	Spanish (wife); no spoken skills.
5	Meriden, CT / Buffalo, NY	MAE	French (5 years)
6	No survey	No survey	None specifically
7	Poughkeepsie, NY	MAE	None specifically
8	Kendall, Miami, FL	MAE, SE, SIE	Basic Spanish, Basic Amharic
9	Glen Falls, NY	MAE, CE	French
10	Brooklyn, NY	MAE	Latin, Spanish, Yiddish/Hebrew
11	Bayonne, NJ	AAE, MAE, SIE, SE	None specifically
12	Jeromesville, Ohio	MAE	Spanish
13	Point Pleasant, NJ	MAE,	Spanish
14	Phoenix, Arizona	MAE, CE	None specifically
15	Houston, TX	MAE, SE	None specifically

Legend
MAE=Mainstream American English, AAE=African American English, SE=Southern English CE=Canadian English, CAE=Chicano American English (Mexican English), SIE=Spanish Influenced English, AE=Appalachian English, O=Other

5.3 Behavioral Results

Behavioral data for response type and reaction time were collected as part of a grammaticality judgment task conducted in both blocks of the experiment, each with two conditions (i.e., *Sentence Types 1/2* and *3/4,* also expressed as *– s marked/omitted* and *accusative/nominative*). The following preliminary behavioral results are based on data collected from two groups of American English speakers: bidialectal (AAE-MAE; n=13) and monodialectal (MAE; n=15). After listening to each presented sentence, participants were asked to select ‘acceptable’ or ‘unacceptable’ via numbered button-press (1 or 2) using a button box that was placed on a table in front of them. The button box interfaced with the data acquisition computers and provided two types of data: the response (button 1 vs button 2, or “acceptable” vs “unacceptable” judgments made by participants) and latency to response in milliseconds post stimulus onset. The grammaticality judgment task data presented below were subjected to two-tailed independent samples t-tests assuming unequal variance, to evaluate differences between response type and reaction time in each block / condition.

5.3.1 Block 1: The –s Marker Grammaticality Judgment Task.

The –s marked/omitted, present progressive tense verb is the target of interest in this condition (*Sentence Types 1/2)*. Behavioral responses are expected to differ significantly between monodialectal and bidialectal speakers. Behavioral responses in each condition were marked as 1 or 0 by Eprime software. In sentence type 1 (–s marked), a response of *acceptable* resulted in Eprime marking the sentence as *correct* and a score of 1 was assigned; if participants responded that an –s marked sentence was *unacceptable*, then the response was given a score of 0 for being *incorrect*. In sentence type 2 (–s omitted) a response type of *acceptable* resulted in Eprime marking the sentence as *AAE-biased* (or error, potentially) and a score of 0 was assigned; if participants responded that an –s omitted sentence was *unacceptable*, then the response was given a score of 1. Summed scores for each participant were then averaged by condition, for each group (see Table 9 below). An independent samples t-test was then applied to the scores in each group for each condition in Block 1. In sentences with an –s marked verb (e.g., *The black cat laps the milk*), no significant difference in grammaticality response was expected between groups, and this prediction was supported by the results of this study (t (26) = 1.4, p = .183). In the condition where the –s omitted verb was presented in the same sentence (e.g., *The black cat lap_ the milk*), it was predicted that behavioral responses would not differ due to the expectation that listeners would codeswitch to the mainstream dialect in formal settings (like that of the lab in which the experiment took place). This prediction was contradicted by the findings. An independent samples t-test indicated responses between groups were significantly different for the –s omitted condition (t (26) = 2.289, p =.039), demonstrating that bidialectal speakers more often selected 'acceptable' for sentences with the –s *omitted* on the present progressive tense verb. Average response times in the –s marked and omitted condition were not significantly different between groups. Average response types and times are presented in Table 9 below. A depiction of mean response type and time per participant in each group for each condition in Block 1 can be seen in Figures 6, 7, 8 and 9.

Table 9: *Behavioral Response to Grammaticality Judgment Task in Block 1*

Groups	**'-s' Marked Response Type**	**'-s' Omitted Response Type**	**'-s' Mark Reaction Time**	**'-s' Omitted Reaction Time**
Monodialectal	0.963 (SD=.045)	0.906 * (SD=.147)	711.43ms (SD=354.28)	746.22ms (SD=382.35)
Bidialectal	0.908 (SD=.136)	0.736 * (SD=.242)	771.33ms (SD=310.22)	712.44ms (SD=263.7)

Note. *Response types in the –s omitted conditions were significantly different between groups (t (26) = 2.289, p =.039).

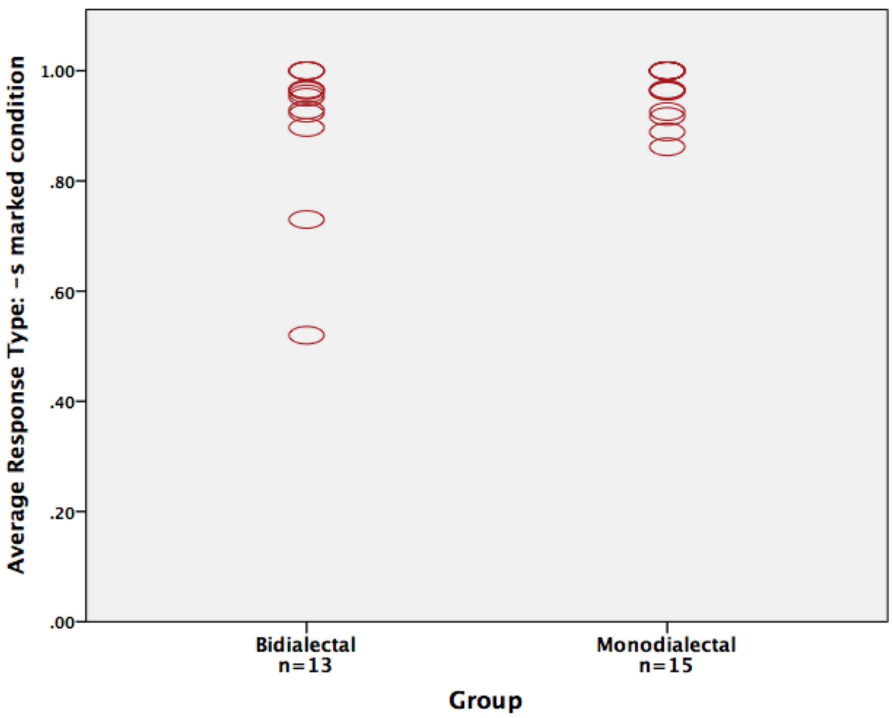


Figure 6. *Scatterplot demonstrating individual average response types for the –s marked condition within each group.* A rating closer to 1.00 indicates greater accuracy (i.e., 'acceptable' responses). Accuracy for sentences with –s marked verbs (e.g., *The black cat laps the milk*) were not significantly different between groups.

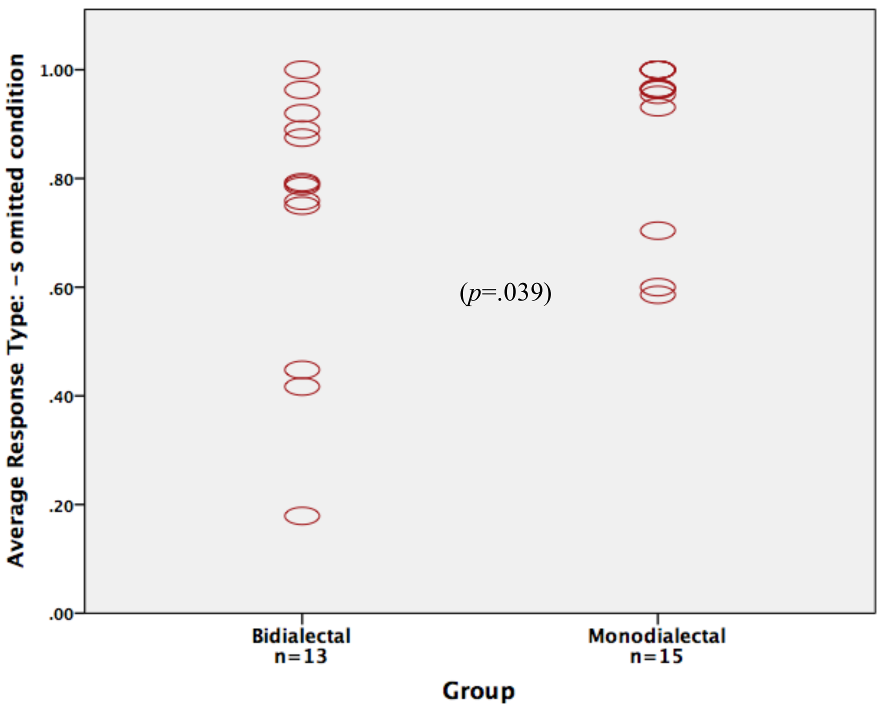


Figure 7. *Scatterplot demonstrating individual average response types for the –s omitted condition within each group.* A rating closer to 1.00 indicates a more MAE-biased acceptability rate (i.e., here, more 'unacceptable' responses). Acceptability for sentences containing –s omitted verbs (e.g., *The black cat lap_ the milk*) were significantly different between groups (*p*=.039), wherein bidialectal speakers accepted a greater percentage of these sentences.

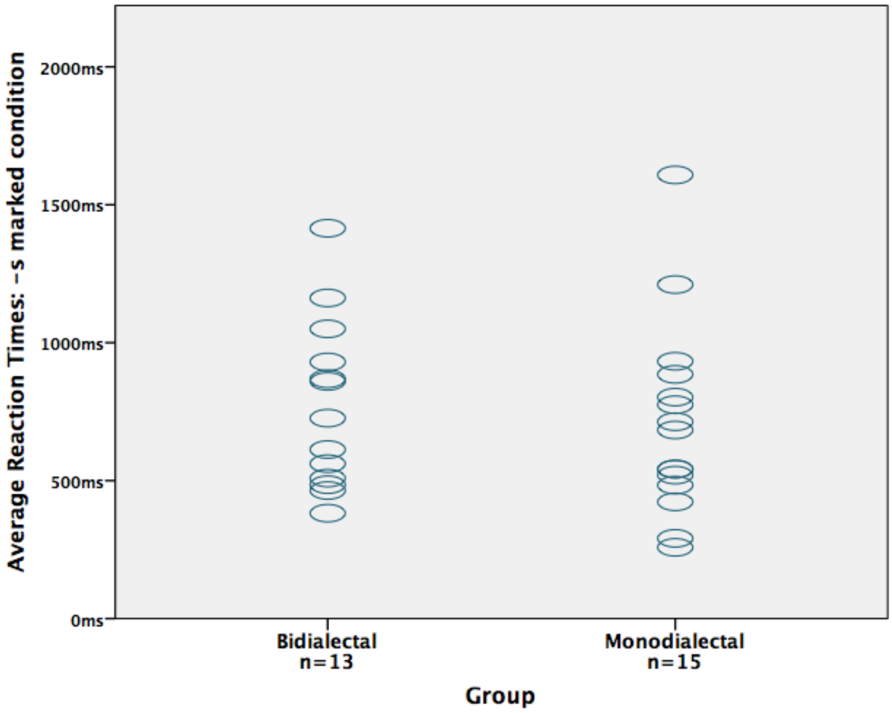


Figure 8. *Scatterplot demonstrating individual average response times for the –s marked condition within each group.* No significant latency differences for sentences containing –s marked 3rd person present tense verbs (e.g., The black cat laps the milk) were found between groups.

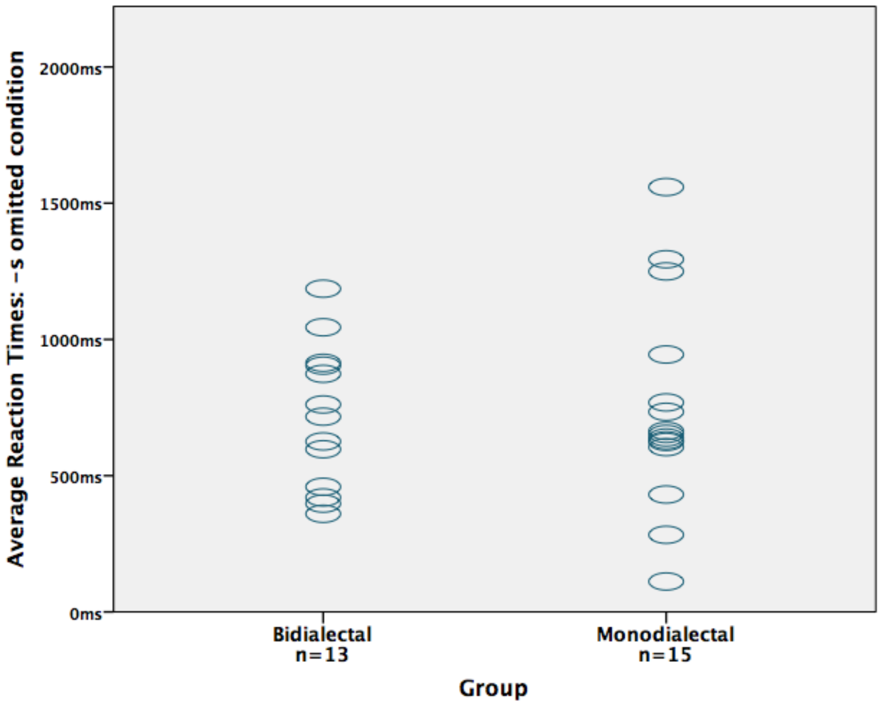


Figure 9. *Scatterplot demonstrating individual average response times for the –s marked condition within each group.* No significant latency differences for sentences containing –s omitted 3rd person present tense verbs (e.g., *The black cat lap_ the milk*) were found between groups.

Because a significant difference in response type per condition was found between groups, nominal data on *acceptable* and *unacceptable* responses were cataloged and are presented below in Table 10 as percentages of the total. It appears based on these data that *acceptable* responses for –s omitted sentence types were greater in the bidialectal group, who accepted these sentence types in 25.8% of trials, compared to the monodialectal group, who accepted these sentence types in 7.2% of trials.

Table 10: *Percentage of Response Types in Block 1*

		Acceptable	Unacceptable
-S Marked	**Bidialectal Group**	90.7	10.3
	Monodialectal Group	96.7	2.3
-S Omitted	**Bidialectal Group**	25.8	74.2
	Monodialectal Group	7.2	92.8

5.3.2 Block 2: The Case Agreement Grammaticality Judgment Task.

The case conditions in Block 2 of the current study are meant to present another grammaticality judgment task in two new conditions (*Sentence Types 3/4*) where one contains a shared morphosyntax violation that applies to both groups' language varieties. Behavioral responses in each condition were marked as 1 or 0 by Eprime software. In sentence type 3 (*accusative*), a response of *acceptable* resulted in Eprime marking the sentence as *correct* and a score of 1 was assigned; if participants responded that an *accusative* sentence was *unacceptable*, then the response was given a score of 0 for being *incorrect*. In sentence type 4 (*nominative*) a response of *acceptable* resulted in Eprime marking the sentence as *incorrect* and a score of 0 was assigned; if participants responded that a *nominative* sentence was *unacceptable*, then the response was given a score of 1 for being *correct.* Scores were then averaged (see Table 11 below).

In sentences where there was case agreement (i.e., accusative condition) or disagreement (i.e., nominative condition), it was expected that there would be no significant difference between groups' grammaticality judgments, since both sentence types have shared syntax rules across language varieties. This prediction was contradicted by findings in this study, and significant differences of response type were found between groups in the *nominative* condition (t (25) = 2.537, p = .023), but not the *accusative* condition, though a trend toward significance may be suggested (t

(25) = 1.831, p = .087). A significant difference in response time between groups was also found in the *nominative* condition (t (25) = 2.537, p=.023) but not the *accusative* case condition (t (25) = -1.566, p=.131). Average accuracy and response times are presented in Table 11. A depiction of mean response type and time per participant in each group for each condition in Block 2 can be seen in Figures 10, 11, 12 and 13.

Table 11: *Behavioral Response to Grammaticality Judgment Task in Block 2*

Groups	Accusative Case Accuracy	Nominative Case Accuracy	Accusative Case RT	Nominative Case RT
Monodialectal	0.972 (SD=.046)	0.979* (SD=.029)	603.15ms (SD=319.36)	526.71ms* (SD=181.17)
Bidialectal	0.905 (SD=.125)	0.913* (SD=.09)	763.26ms (SD=202.85)	726.91ms* (SD=206.43)

Note. *Grammaticality judgments and reaction time (RT) for the *nominative* (i.e., subjective; he/she/they) case were significantly different between groups; (t (25) = 2.537, p=.023) and (t (25) = -2.67, p=.013), respectively.

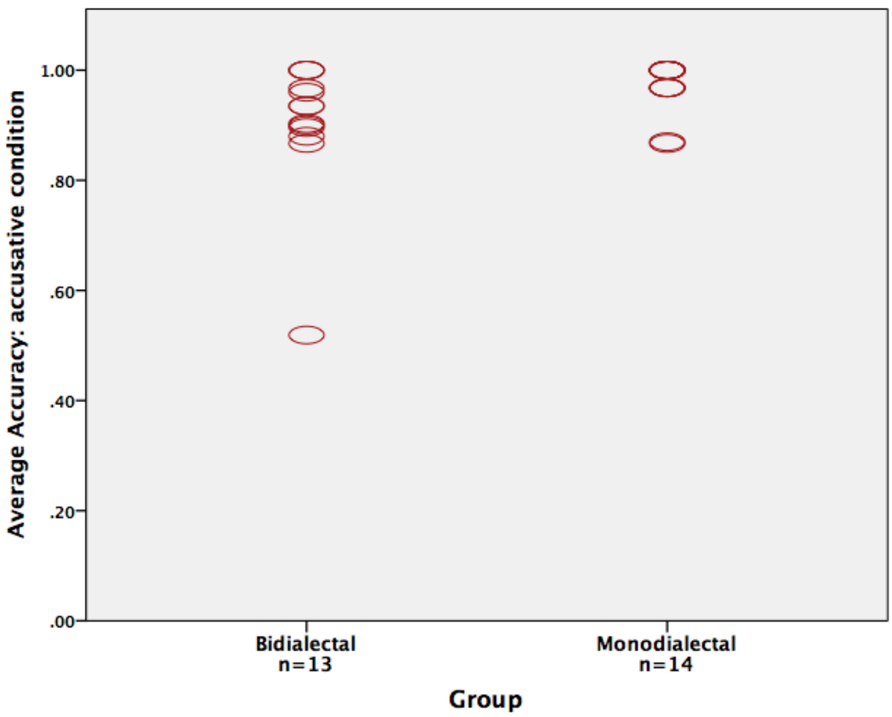


Figure 10. *Scatterplot Demonstrating Individual Average Accuracy for the Accusative Condition Within Each Group.* A rating closer to 1.00 indicates greater accuracy (in this case, more 'acceptable' responses). Grammaticality judgments for these sentences, containing verb agreements (e.g., *The angry husband avoids her…*) were not significantly different between groups.

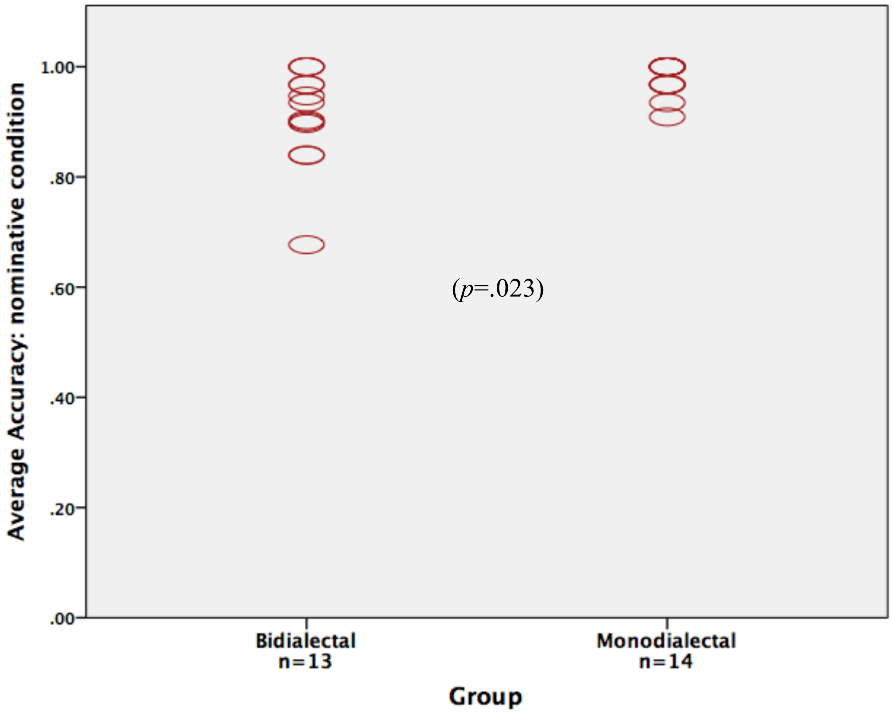


Figure 11. *Scatterplot Demonstrating Individual Average Accuracy for the Nominative Condition Within Each Group.* A rating closer to 1.00 indicates greater accuracy (in this case, more 'unacceptable' responses). Grammaticality judgments for these sentences, containing verb disagreements (e.g., *The angry husband avoids she…*) were significantly different between groups (p=.023) indicating bidialectal speakers accepted a greater percentage of these sentences than monodialectal speakers.

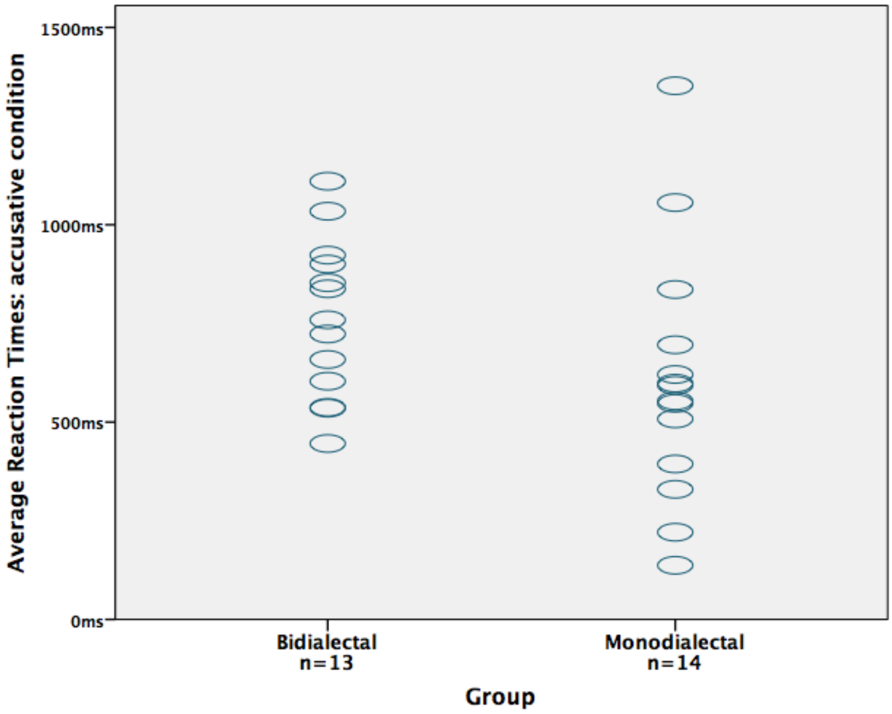


Figure 12. *Scatterplot Demonstrating Individual Average Response Times for the Accusative Condition Within Each Group.* No significant latency differences for sentences containing verb agreements (e.g., *The angry husband avoids her…*) were found between groups.

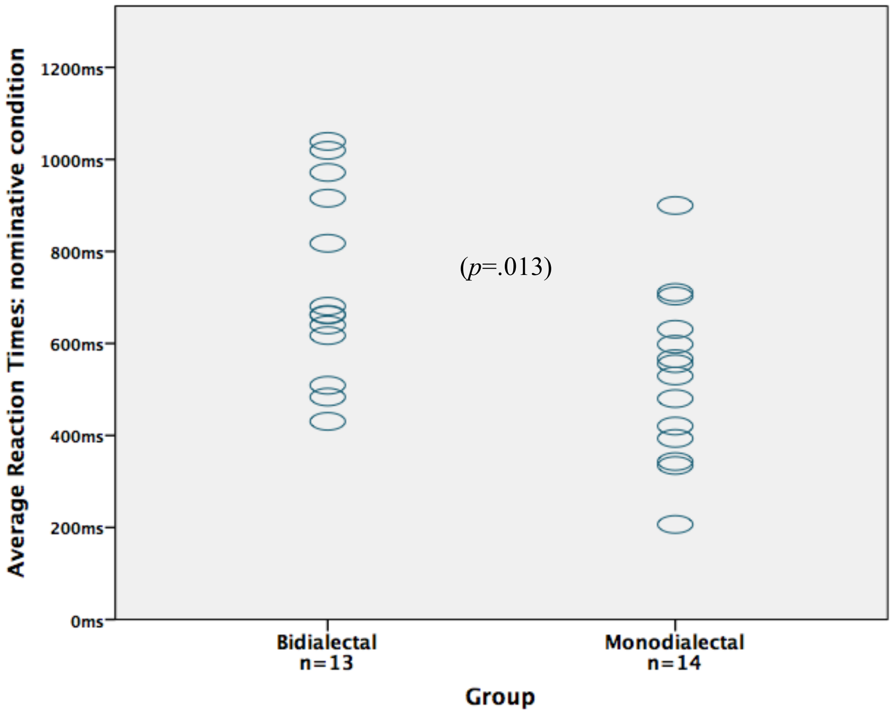


Figure 13. *Scatterplot Demonstrating Individual Average Response Times for the Nominative Condition Within Each Group.* A significant latency difference for sentences containing verb disagreements (e.g., *The angry husband avoids she…*) was found between groups (p=.013), indicating greater latency for the bidialectal group.

Because a significant difference in both average response type and reaction time was found between groups, all *acceptable* and *unacceptable* responses to the two Case conditions were catalogued and are presented below in Table 12 as percentages of the total number of trials. Across dialects, the *nominative* condition presents sentences that are likely not acceptable language variations for the speakers in this study (e.g., The angry husband avoids *she* in the driveway). However, findings indicate that the bidialectal group classified 8.2% of these sentences as *acceptable*, compared to the monodialectal group who found 1.9% of these *acceptable*. Similarly, across dialects, the *accusative* condition presents sentences that are acceptable in the given language variety (e.g., The angry husband avoids *her* in the driveway.)

Table 12: *Percentage of Response Types in Block 2*

		Acceptable	**Unacceptable**
Accusative Case	**Bidialectal Group**	89.8	10.2
	Monodialectal Group	97.4	2.6
Nominative Case	**Bidialectal Group**	8.2	91.8
	Monodialectal Group	1.9	98.1

5.4 P600 Analysis

The following ERP results are based on data collected from two groups of American English speakers: bidialectal (AAE-MAE; n=14) and monodialectal (MAE; n=13). Statistical analyses were performed to determine significance of the effects observed in the selected montage (see Chapter 4). Analyses of the P600 component are reported in this section between subjects (monodialectal/bidialectal) for each block (Block 1 and Block 2), with alpha level for all analyses set to 0.05. The grand average waveforms for each condition per block are shown in the figures below. Split-plot repeated-measures ANOVAs on mean amplitudes were conducted to analyze effects and interactions for factors *sentence type* (– s marked/omitted and nominative/accusative) and *group* (AAE-MAE listeners and MAE-only listeners). Additionally, data were partitioned by *hemisphere* (left vs. right) for further investigation of differences between amplitudes recorded from left and right hemisphere electrodes, for each sentence type and/or group, in order to answer some secondary research questions related to laterality in this study.

5.4.1 Block 1: Mean Amplitudes of – s Marked/Omitted Conditions.

A two-way analysis of variance having one between subjects factor (GROUP) with two levels (monodialectal/bidialectal) and one within-subjects factor (SENTENCE TYPE) with 2 levels (S-MARK/S-OMIT) was carried out on the mean amplitudes per condition for each participant within each group. The main effect of *sentence type* was significant (F (1, 25) = 10.837, p = .003), indicating a difference in mean amplitudes between conditions. The interaction between *group* and *sentence type* was also significant (F (1, 25) = 5.461, p = .028). A follow-up independent samples t-test evaluating mean amplitude differences for each condition between groups revealed a significant difference between group means in the *–s omit* condition (t (25) = 2.503, p = .019). No significant differences were noted between groups in the *–s mark* condition (t (25) = .456, p = .652).

In the *–s omit* condition, the data failed the assumption of homogeneity of variance according to Levene's test of equal variance (p=.03). Therefore, analyses were repeated under assumptions for non-parametric data for both conditions. A Kruskal-Wallis H test confirmed previous findings that there was a statistically significant difference between dialect groups in the *–s omit* condition (χ^2(1, n=27) = 4.559, p = .033), with a mean rank amplitude score of 10.86 for the bidialectal group and a mean rank amplitude score of 17.*38* for monodialectal group. A partial eta was calculated and the proportion of variability accounted for by being either a monodialectal or bidialectal speakers was .175, indicating a fairly strong relationship (i.e., effect size) between language variety and P600 amplitudes to *–s omit* sentences.

Table 13 and Figures 14 and 15 provide descriptive statistics and a box plot for visualization of mean amplitudes from 400 to 800ms following target stimulus onset.

Table 13: *Mean amplitude (µV) in the 400-800ms Time Window for Block 1*

Group	Mean Amplitude S-MARK	Standard Deviation
BIDIALECTAL (n=14)	0.567 µV	1.258
MONODIALECTAL (n=13)	0.779 µV	1.132
Group	**Mean Amplitude S-OMIT**	**Standard Deviation**
BIDIALECTAL (n=14)	0.748 µV *	0.826
MONODIALECTAL (n=13)	1.847 µV *	1.401

Note. *Mean amplitudes in the S-Omit condition were significantly different between groups (t (25) = 2.503, p= .019).

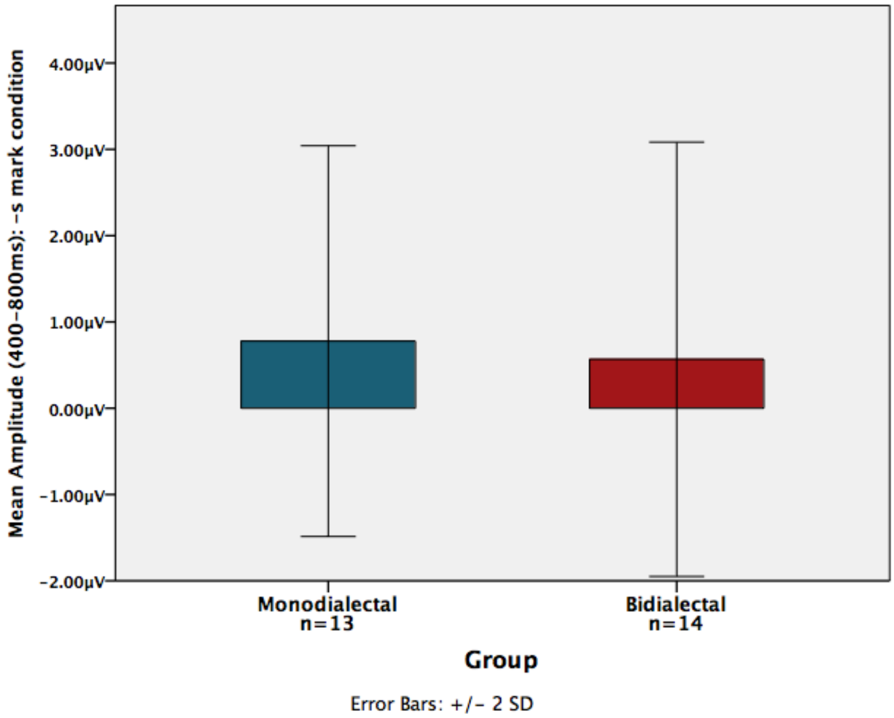


Figure 14. *Comparison of Mean Amplitudes from 400-800ms in Block 1*. The –s marked condition (e.g., *The black cat laps...*) is shown for each group with error bars for +/- 2 SD. Group responses were not significantly different.

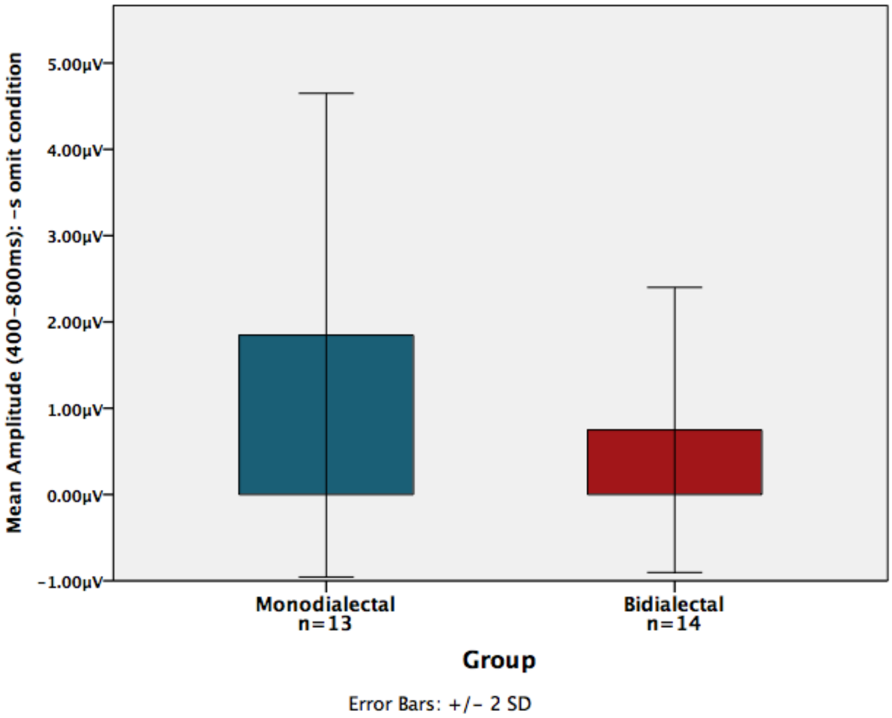


Figure 15. *Comparison of Mean Amplitudes from 400-800ms in Block 1.* The –s omit condition is shown for each group with error bars for +/- 2 SD (e.g., *The black cat lap_...*). Monodialectal group's responses were significantly more positive in amplitude than the bidialectal group (t (25) = 2.503, p= .019).

For Block 1 (comparing –s marked and –s omitted conditions), the grand averaged waveforms are illustrated in Figure 16 below for the full segment window of 0-1100ms following target stimulus onset. A repeated measures ANOVA between conditions within the relevant time window of 400-800ms for each group demonstrated a significant difference between –s mark/omitted sentences (F (1, 12) = 17.121, p = .001) for monodialectal speakers. No significant difference between conditions was seen for bidialectal speakers (F (1, 13) = .431, p = .523).

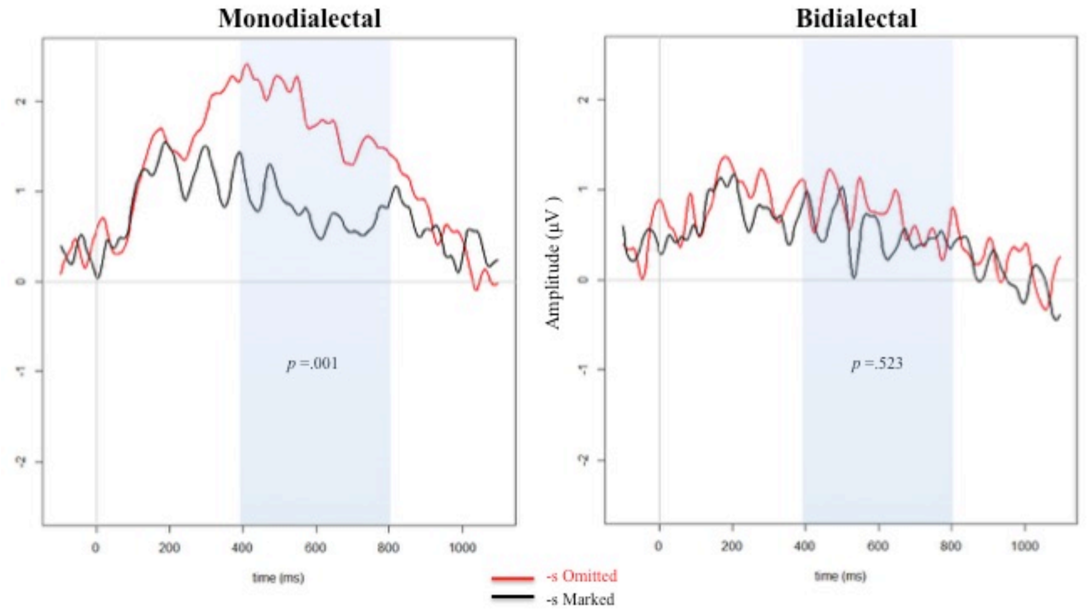


Figure 16. *Grand Average Waveform in Block 1.* The –s omit condition is shown in red and –s marked condition in black. Monodialectal (left) and bidialectal (right) responses are shown from 0-1100ms post-target stimulus onset during the listening task in the –s marked/omitted condition ("The black cat lap_ the milk."). Repeated measures ANOVA between conditions illustrated a P600 effect for the monodialectal group (p =.001) in the relevant time window of 400-800ms. The bidialectal (AAE-MAE) group showed no significant difference between conditions (p =.523).

5.4.2 Block 2: Mean amplitudes of the case agreement conditions.

A two-way analysis of variance having one between subjects factor (*group*) with two levels (monodialectal/ bidialectal) and 1 within-subjects factor (*sentence type*) with 2 levels (accusative/nominative case) was again performed, this time for the Block 2 data. The main effect of *sentence type* was significant (F (1, 25) = 19.830, $p < .001$), indicating a difference in mean amplitude between conditions. The interaction between *group* and *sentence type* was not significant (F (1, 25) = .076, p = .785). Follow-up independent samples t-tests comparing mean amplitudes in each condition revealed no significant difference between group means for either sentence type (accusative: t (25) = -.320, p = .751; nominative: t (25)= -.053, p = .959). Table 14 and Figures 17 and 18 provide mean amplitudes and a plot for visualization of the amplitude data from 400 to 800ms following target stimulus onset.

Table 14: *Mean amplitude (µV) in the 400-800ms Time Window for Block 2*

Group	Mean Amplitude Accusative Case	Standard Deviation
BIDIALECTAL (n=14)	-2.80 µV	0.783
MONODIALECTAL (n=13)	-0.398 µV	1.121
Group	**Mean Amplitude Nominative Case**	**Standard Deviation**
BIDIALECTAL (n=14)	0.486 µV	0.667
MONODIALECTAL (n=13)	0.469 µV	1.029

Note. Mean amplitudes (uV) were not significantly difference between groups across conditions.

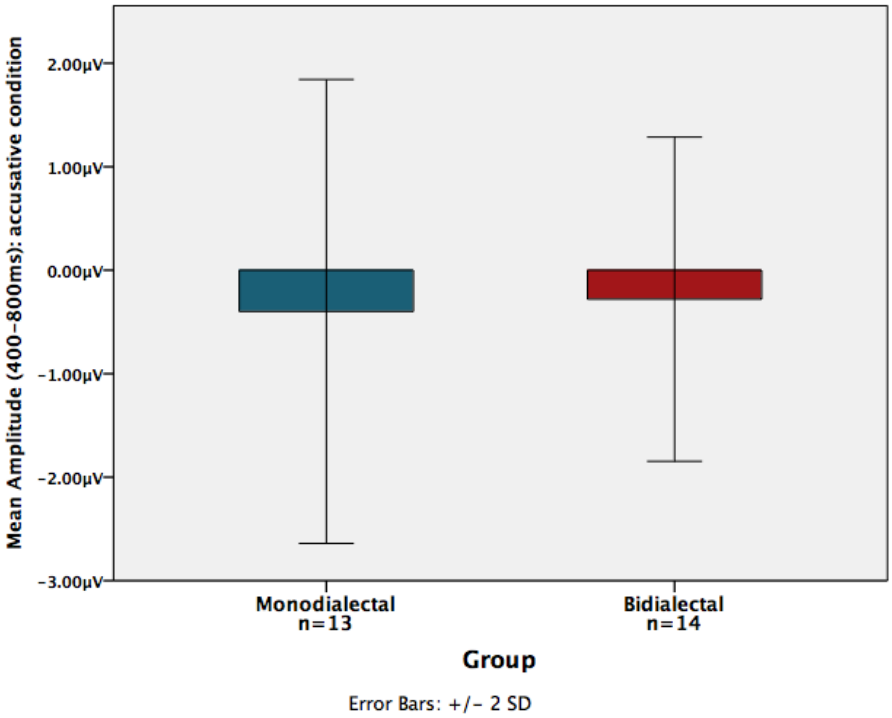


Figure 17. *Comparison of Mean Amplitudes from 400-800ms in Block 2*. The accusative condition is shown for each group with error bars for +/- 2 SD (e.g., *The angry husband <u>avoids</u> <u>her</u>...)*. Responses were not significantly between groups.

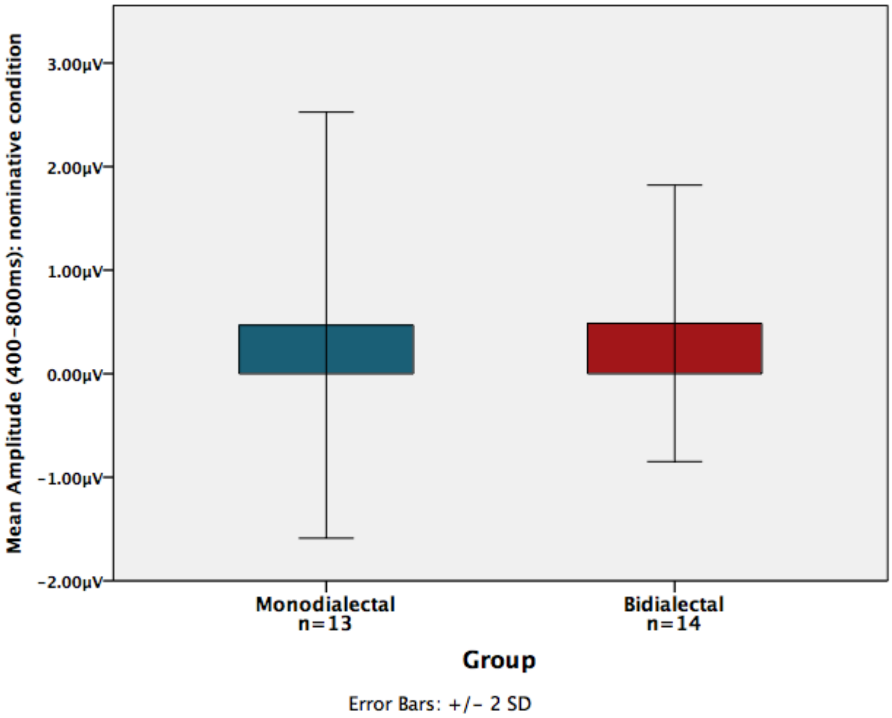


Figure 18. *Comparison of mean amplitudes from 400-800ms in Block 2*. The nominative condition is shown for each group with error bars for +/- 2 SD (e.g., *The angry husbands avoids she…)*. Responses were not significantly between groups.

For Block 2 (nominative vs. accusative pronoun case), grand average waveforms are illustrated in Figure 19 below for the full segment window of 0-1100ms following target stimulus onset. A repeated measures ANOVA between conditions for each group in the 400-800ms segment demonstrated a significant difference in mean amplitudes between the nominative/accusative conditions for both the monodialectal speakers (F (1,12) = 9.998, p = .008) and bidialectal speakers (F (1,13) = 9.767, p =.008).

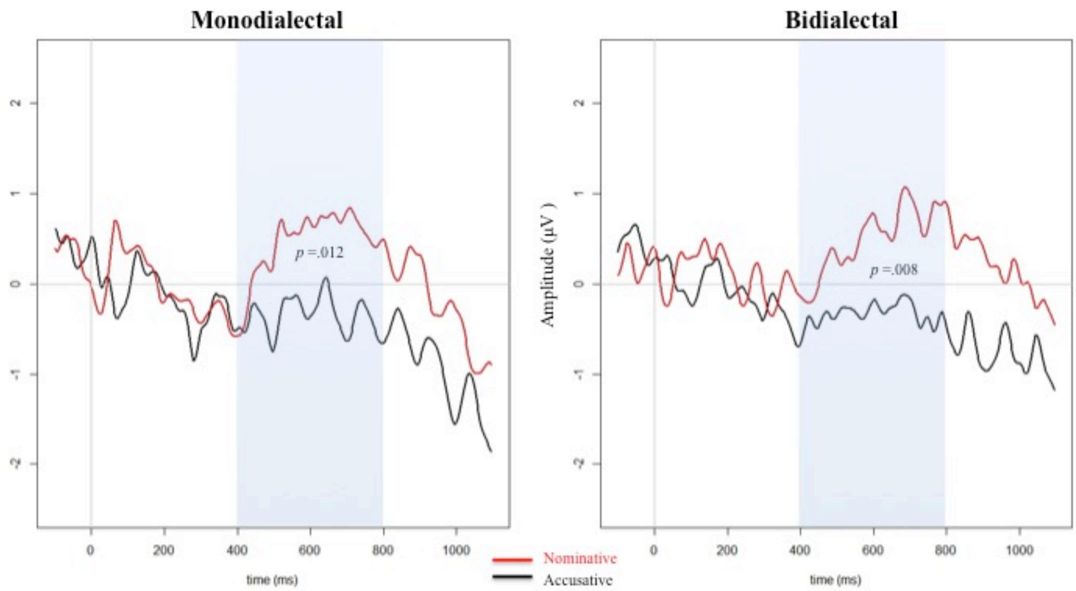


Figure 19. *Grand averaged waveforms for Block 2 (nominative/accusative condition)*. Both groups show a significant difference between conditions, demonstrating a more positive (i.e., P600) response in the nominative condition (red line), with no significant difference seen between groups (p =.785) in the 400-800ms time window across conditions.

5.5 Laterality Analyses

A post hoc analysis of laterality was conducted by performing a repeated measures (univariate) ANOVA with dependent variable *mean amplitude* (from 400-800ms) and factors *group* (MAE/AAE-MAE), *sentence type* (-s mark/omit, accusative/nominative) and *hemisphere* (left/right). Data collected from electrodes of interest over left and right hemispheres were separated out, and analyzed by comparing mean amplitudes from the P600 time window (400-800ms) between the electrode groups listed in Table 14. Further repeated measures ANOVAs and follow-up planned comparisons were performed for relevant main effects seen in each group.

Table 15: *Electrode groupings on the 128-channel HydroCel Geodesic Sensor Net*

Montage	Electrodes
P600	54, 55, 61, 62, 72, 78, 79
Left Hemisphere	52, 53, 54, 59, 60, 61, 66, 67
Right Hemisphere	77, 78, 79, 84, 85, 86, 91, 92

In Block 1, the effect of *hemisphere* was close to significance (F (1,100) = 3.529, p =.063), but there was no significant interaction with *group* or *sentence type*, indicating that response amplitudes may be marginally greater over right hemisphere sensors than left in both groups, across conditions. Figure 20 below illustrates this in the grand averaged waveforms for each group, seen here from 0-1100ms in order to compare onset and recovery time of the P600 component, though analyses were performed from 400-800ms.

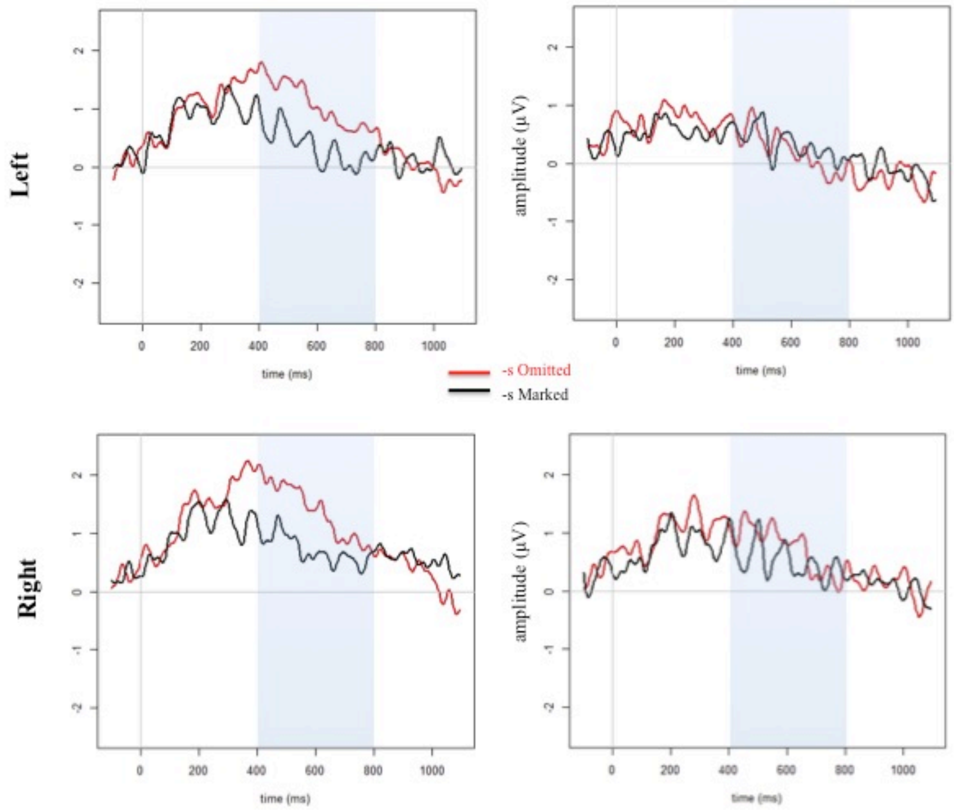


Figure 20. *Grand averaged waveforms from 0-1100ms for electrodes in the left and right hemisphere in Block 1.* The –s mark/omitted conditions are presented for visualization of onset/offset of the P600 component. Analyses performed in relevant P600 time window of 400-800ms demonstrated no significant difference across hemispheres.

In Block 2, there was no main effect of *hemisphere* between groups, indicating no significant difference between left and right mean amplitudes from 400-800ms. More equivalent bilateral activation may therefore be occurring across groups and conditions in Block 2 compared to Block 1. Figure 21 below demonstrates the grand averaged waveform from 0-1100ms in order to compare onset and recovery time of the P600 component across hemispheres. Analyses were performed in the 400-800ms time window relevant to the P600 component.

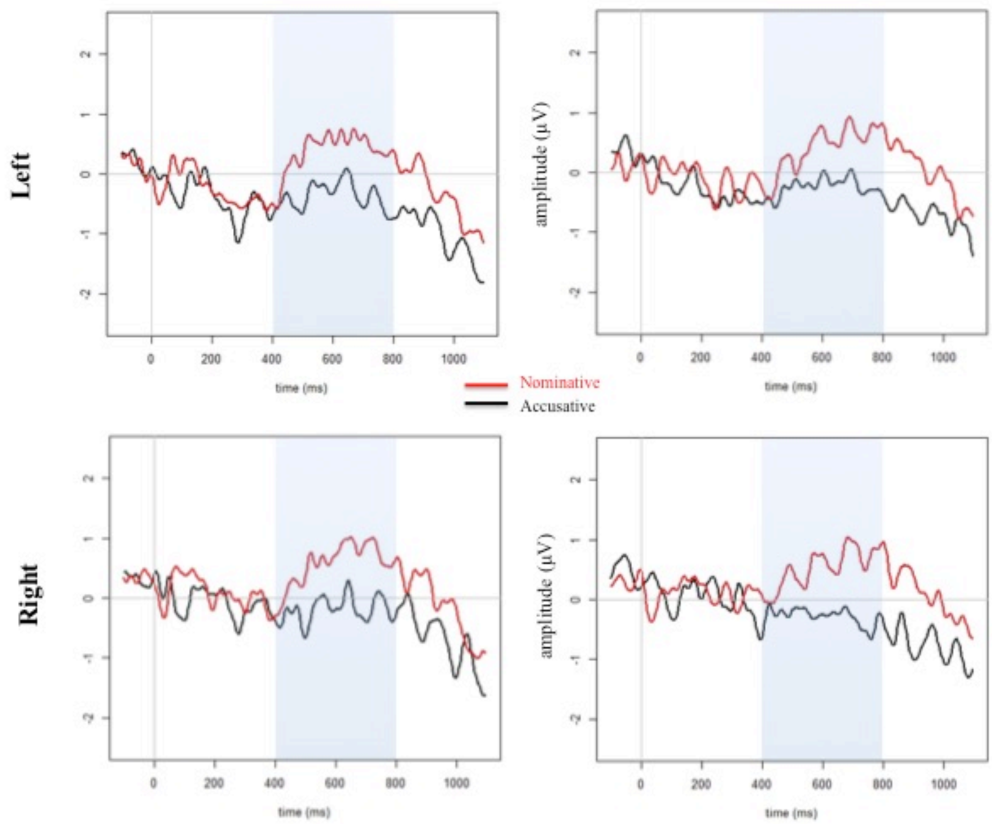


Figure 21. *Grand averaged waveforms from 0-1100ms for electrodes in the left and right hemisphere in Block 2.* Nominative/Accusative conditions are presented for visualization of onset/offset of the P600 component. Analyses performed in relevant P600 time window of 400-800ms demonstrated no significant difference across hemispheres.

5.6 Summary

These analyses have provided some supporting and some opposing evidence to the presented hypotheses, as well as a starting point for secondary questions. A set of experimental conditions were presented in Block 1 with the presentation of sentences with –s marked or omitted on a third person present tense verb. With regard to behavioral responses, it was hypothesized that there would be no significant difference between groups' acceptability responses to AAE morphosyntax features (i.e., *-s omit*), while reaction times would be greater for these sentence types. Findings in this study presented exactly the opposite evidence, with no significant difference seen in reaction times for grammaticality judgments across conditions, between groups, and with the bidialectal (AAE-MAE) group showing significantly less MAE-biased responses to (i.e., greater acceptability of) *–s omit* sentences (p=.039).

With regard to ERP analyses, it was hypothesized that bidialectal speakers would not demonstrate a P600 ERP response to sentences containing a feature of AAE dialect morphosyntax. Evidence in support of this hypothesis was found when groups showed no significant difference in amplitude when listening to *–s mark* sentences, but did demonstrate a significantly different amplitude when listening to *–s omit* sentences (p=.019). This finding suggests that a P600 response was elicited form the monodialectal group for the *–s omit* sentence type, indicating the demand for reanalysis/repair during auditory processing for this feature; this response was not elicited from the bidialectal group.

A set of control conditions were presented in Block 2 which were thought to elicit both behavioral and ERP results that would not be significantly different between groups. However, some surprising differences appeared with regard to accuracy and reaction times in response to nominative sentence types. While accusative sentence types were not associated with a significant difference in response time or accuracy between groups, nominative sentences elicited significantly greater reaction times (p=.013) and higher acceptability ratings by the bidialectal group (p= .023).

A secondary question regarding activation across hemispheres was also investigated, based on the notion that brain activations from bilingual speakers may be more equivalent between hemispheres compared to monolingual speakers, who may show greater left-side lateralization for P600 responses. Results here demonstrated no significant difference in hemispheric lateralization of the P600 response across conditions and groups.

These findings support a view of bidialectal speakers as speakers of two language varieties, perhaps not unlike bilingual speakers. What follows here are conclusions related to these findings and suggested directions for future research, including a consideration of the limitations of the current study.

6. DISCUSSION

6.1 Conclusions

This dissertation study investigated how bidialectal and monodialectal speakers of American English respond to morphosyntactically contrasting and non-contrasting sentence types. In Block 1, contrasting sentence types were presented, and bidialectal speakers showed significantly greater acceptability of *–s omit* sentences during the grammaticality judgment task, and lower mean amplitudes in the P600 time window than the monodialectal group; meanwhile, no significant differences were seen between groups in the non-contrasting condition (*-s mark*). In Block 2, two non-contrasting sentence types were presented, one of which contained a shared rule violation. Although the groups demonstrated no significant ERP differences to either condition, the bidialectal group demonstrated behavioral response differences, including greater latency and acceptability of *nominative* sentence types. The findings in Blocks 1 and 2 provide some interesting evidence for tentative conclusions.

The findings of this dissertation point to the possibility that bidialectal comprehenders may experience a different processing pattern for morphosyntactic codeshifts between mainstream and nonmainstream language varieties than has been documented thus far in the bilingual and L2 learner literature. In studies with translation-equivalent semantic codeswitches, a shift between languages – like Spanish and English – is known to elicit a significant P600 effect (Moreno et al., 2002; 2008). Therefore, this effect has been thought to reflect a cross-linguistic difference rather than a within-language switch. Within-language semantic codeswitches are associated with N400 effects instead, suggesting that when two language varieties are perceived as the same language, the codeswitch is treated like a semantic anomaly (Khamis-Dakwar & Froud, 2005). This dissertation study presented a dialectal morphosyntactic shift (the *–s mark*/*omit* condition for bidialectal speakers), and supporting evidence was found for the hypothesis that this shift would elicit neither an N400 nor P600, since both forms are acceptable and the shift is not semantic in nature. Given the literature to date, the current findings would suggest that either: 1) morphosyntactic shifts between two dialectal language varieties are not associated with the same cognitive "cost" as translation-equivalent semantic switches; 2) that there is another – as yet unknown – brain event-related component, distinct from the N400 or P600, that indexes dialectal morphosyntactic switching; or 3) that

MAE to AAE switches specifically are not distinctly represented, perhaps because they have too much overlap. The latter possibility is not favored here because of the observed behavioral differences between groups.

One explanation for this potential difference in processing between monodialectal and bidialectal listeners could be that there are different constraints on codemixing patterns for each group. That is, for many bidialectal speakers, a *switch* is always available, because the forms that define the nonmainstream language variety are meant to be mixed with features of the mainstream variety (even though the use of the nonmainstream variety may be domain specific – Labov, 1972). It is therefore possible that a reduced late positivity (as was seen in Block 1) in the bidialectal group in response to acceptable morphosyntax shifts reflects a reduced need for (or access to) cognitive reanalysis. Further research is needed, of course, to elucidate how language processing for speakers of dialectal language varieties with differing morphosyntax patterns is both comparable to, and distinct from, language processing in monolinguals and in speakers of other language varieties with additional vocabulary differences (e.g., English/Spanish bilinguals, or diglossic speakers of Standard and Colloquial varieties of Arabic).

In terms of behavioral findings, bidialectal speakers in the current study showed increased acceptance of a known dialectal variation (i.e., *-s omit*) and error sentences (i.e., *nominative*), despite showing reduced late positivity responses to the AAE-MAE feature only. Increased acceptance of sentences containing dialectal features in a grammaticality decision task was also reported by Conrey et al. (2005), in a study examining phonological and semantic differences across two NMAE dialects. In the *nominative/accusative* conditions of Block 2, bidialectal listeners showed increased reaction times in response to both sentence types, in addition to the increased acceptability responses to a shared error (i.e., *nominative* sentence types), suggesting the possibility that there is an augmented cognitive load in grammatical decision-making situations where the possibility of error between dialects exists, and is considered later, during a decision-making stage. This could result in hypo- or hyper-correction, dependent on aspects of the context under which decisions are being made.

Bilingual speakers of two distinctly perceived languages in similar tasks have also been shown to have increased latencies of brain responses to both correct and incorrect sentences in past ERP studies, though electrophysiological responses demonstrate modulation by exposure, among other variables (Moreno, et al., 2008; Osterhout, McLaughlin, Pitkänen, Frenck Mestre, & Molinaro, 2006). In this way, the bidialectal listeners in the present study appeared to be responding similarly to highly proficient bilingual speakers, since they demonstrated behavioral differences from the monodialectal speakers, even in response to shared rule violations of English. Further analysis for acceptability percentages under each condition (i.e., sentence type) might further provide insight into individual response patterns and may provide a prediction of behavioral and neurophysiological responses through regression analyses.

Since mean response times and acceptability ratings in bidialectals were increased compared to monodialectals in our shared-violation condition (*nominative* sentence types), and since longer response times have been known to reflect the late-stage processing and working memory costs associated with the P600 effect, then these findings may serve to show that the relative sociolinguistic status of language varieties spoken by an individual (i.e., the conceptualized distance between them) may modulate behavioral patterns and may also be associated with distinct ERP responses (not seen in this study) depending on the parameter. For example, an unexpected-but-acceptable dialectal syntax shift may be associated with different ERP responses than a translation-equivalent codeswitch in a diglossic group; and both of these may show a variably distinct profile compared to bilinguals for processing particular aspects of language with more/less distance between them. Different neurophysiological profiles and behavioral responses would thus be dependent on both conceptualized distance between varieties and on various linguistic parameters. Some initial evidence for this idea in the present study may be seen in the results from the *–s omit* condition, where the bidialectal listeners' *lack* of a P600 response to a morphosyntactic shift may predict decreased discrimination in behavioral responses. This also provides support for Khamis-Dakwar and Froud's (2005) finding of significantly more error responses from bidialectal Arabic speakers presented with codeswitched conditions ($p < 0.05$), since both the bidialectal listeners in the present study and the bidialectal Arabic speakers in Khamis-Dakwar and Froud's work are speakers of sociolinguistically defined language varieties that are conceptualized as one language by many speakers. In their study of diglossic switches from MSA to PCA, Khamis-Dakwar and Froud (2005) suggested that the P600 response to intrasententially codeswitched words corroborated a view of MSA and PCA as being represented in the brain as distinct languages. Findings from this dissertation study, however, as well as findings from Conrey et al., (2005), may indicate that different parameters of language are represented differently, and at different cognitive costs, for groups where languages are sociolinguistically conceived as belonging to a single system. One final piece of evidence for this view may be seen in the significantly different accuracies and extended reaction times for bidialectal speakers in response to shared-rule violations. In this case, the *nominative* condition presented sentences that, while incorrect in both MAE and AAE, have a related syntax form in AAE where pronoun differences are acceptable, thus contributing to the suggested increase in cognitive load that resulted in behavioral differences between groups, despite similar ERP responses. Pronoun differences acceptable in AAE have been assigned various descriptions, including: appositive pronouns (e.g., "That teacher, she yell at the kids"); benefactive datives (e.g., "I got me a new car"); demonstrative 'them' (e.g., "I love them shoes"); and simply 'undifferentiated pronoun case' (e.g., "I don't like them bad people) (e.g., Rickford, 1999; Wolfram, 2004; Washington & Craig, 2002).

Research with NMAE varieties is in the earliest of stages, and many unresolved issues remain. Therefore logical assumptions discussed here are only presented as avenues for future inquiry. Comparisons between dialect groups and bilingual groups are tentative at best, since many parameters in either category are often overlapping, depending on the population. Sweeping statements made about what makes some individual a *true* bilingual and/or bidialectal speaker are therefore impossible. It may be that further research will lead to definitions of language varieties categorized by what parameters are overlapping (a bisyntactic speaker? a multisemantic speaker?). A central outcome to this study then, is the presentation of partial evidence that the P600 response to codeswitched, translation-equivalent words reflects between-language switches rather than within-language switches, which are associated with an N400 (Moreno, et al., 2002; Thomas & Allport, 2000).

These findings point to the need for a series of studies to further examine how the processing of morphosyntax differs between language varieties which are sociolinguistically conceived as the same or different language(s). The current study is simply the first to do so, using bidialectal NMAE speakers.

6.2 Study Limitations and Delimitations

This study has several limitations. Firstly, P600 analyses were limited to mean amplitude in the 400-800ms time window, because peak latency was visibly ahead of the known 600ms peak for this component, with maximum peaks appearing closer to the 400ms time window in Block 1 for both groups. The broad, flat waveform shape, and extended positive period with a slow shift back to baseline that was seen in the monodialectal groups' grand averages, clearly defines the response as a late positivity related to reanalysis and repair. Therefore, the early-appearing peak in just Block 1 – whose stimuli were also built somewhat differently than Block 2 – may point to a fault in stimulus creation rather than participant differences. Stimulus onset time, and therefore the ERP segmentation epoch, for the target words in Block 1 trials was individualized for each sentence based on the onset of the /s/ phoneme at the end of the target words. It was assumed that, since decisions were made on the derivation, the segmentation should begin prior to the –s marked/unmarked location rather than at the beginning of the word where they were identical (e.g., lick/licks); this therefore might cause a delayed component response to appear in the data. In Block 2, the target word was presumably identified from word onset, where the contrasting stimuli already differed (e.g., she/her). It may be that digitally shaping target words to be equivalent lengths and segmenting from start of the word, rather than onset of the suffix, would resolve this issue and clarify the timing of the P600-like component in future experiments with stimuli like these.

One additional limitation of having an early-appearing P600 effect in the target condition is that it washed out the time period in which an N400 or LAN might be reliably analyzed for Block 1. Even if time periods were subtracted and windows further ahead of the target were analyzed, analyses could not be equally performed across trials, because of the individually timed nature of the –s mark/omit on the target word in the natural speech stimulus. This limitation would also be resolved by imposing uniform timing for the target word across sentence trials in Block 1.

A limitation of task is also worth considering in this study, especially when interpreting results from Block 2, where both groups demonstrated similar P600 effects despite significantly different latencies in response time for the nominative condition (e.g., "The angry husband avoids she…"). Late positivity responses are reportedly enhanced by the requirement of an explicit decision (e.g., Regnault, Bigand, & Besson, 2001). To evaluate the impact of the behavioral task on timing of the ERP, future studies could compare results of these conditions with and without a subsequent behavioral task.

Finally, an obvious delimitation is that of defining linguistic participant groups on self-report of race and ethnicity (at the exclusion of all other races, ethnicities, and language backgrounds). Self-report is not as specific a requirement as desired for this study; unfortunately no other known option exists at present that would allow for bidialectal individuals without awareness of AAE to be included in the study. One possible method could be to determine eligibility based on dialect density markers observed during a verbal passage reading task, a participant selection criterion that was previously implemented by Conrey, et al. (2005). However, since reading aloud is more likely to reveal a phonological variation of dialect (their target of interest) than a morphosyntactic one, this approach may inadvertently exclude participants whose phonology is more reflective of MAE than their morphosyntactic knowledge might be, thereby limiting our pool to those with pronunciation differences alone. Additionally, this method would exclude bidialectal AAE-MAE speakers with very distinct codeswitching patterns.

6.3 Future Directions

In order to evaluate whether there could be a distinct brain component associated with dialectal codeswitching, an investigation of the N400 component in dialect-shifting is in order. Such analyses may either support or contrast with Conrey et al.'s (2005) unexpected finding of an N400 response to congruently presented pain/pine word pairs in speakers of merged dialects (i.e., participants read the word *pain*, and heard the word "pain", as opposed to reading *pain* and hearing "pine"). This was not expected to elicit an N400 in Conrey et al.'s study because these word pairs are not pronounced similarly by merged-dialect speakers, but in the light of the findings from this dissertation study it may be the case that some dialect-switching was occurring, or at least available, during processing.

If an N400 effect was found to be associated with the bidialectal group's comprehension of *–s omit* sentences compared to monodialectal speakers, this may suggest that morphosyntactic shifts are neurophysiologically realized in a similar way to "within-language" switches (semantic unexpectedness) in bilingual speakers. This would suggest that morphosyntactic switches between dialects are underpinned by similar processes to register changes within a language, for example, rather than reflecting lexical or syntactic shifts between language varieties, which may be more distant. Such a finding may therefore indicate that bidialectal listeners in fact undertake no specific reanalysis of dialectal switch stimuli, at the expense of behavioral discrimination (as reflected in the behavioral outcomes of this dissertation study).

On the other hand, if an N400 effect was found in the *control* condition (during the presentation of correct sentences), similarly to the findings of Conrey et al. (2005), then the integration of language differences may actually be more complex when dialect speakers *expect* a difference but do not encounter one. This could perhaps explain the increased acceptability responses to shared violations with subject-verb disagreement patterns (the nominative condition in Block 2). In turn this would suggest that bidialectal speakers with nearly identical vocabulary to the mainstream variety may not experience "competition" for cognitive resources between their language varieties, unlike traditional bilinguals (e.g., Moreno, et al., 2002). Future analyses targeting the N400 component could therefore provide a way forward in terms of understanding the similarities and differences in processing between bilingual and bidialectal speakers.

6.4 Closing Remarks

This study was the first of its kind in that it undertook a systematic investigation of brain responses to contrasting and non-contrasting morphosyntactic features in sentences across dialects of American English, using ERP methodology. Evidence now exists for differing neurophysiological and behavioral responses in bidialectal listeners compared to mondialectal listeners, and this has far-reaching implications from education to linguistics. Evidence that bidialectal speakers demonstrate a rule-based ERP response to contrasting and noncontrasting sentence patterns confirms the necessity of past and future research into language differences. Additionally, it imparts the need for increased consideration of dialect as a factor in research into language groups. Overall, the findings here provide some valuable insight into the representation of different language varieties in the brain, and how behavioral and neurophysiological responses might be modulated by a speaker living in a sociolinguistic situation where their dialects are perceived as belonging to a single language system. Further investigations are needed to examine other factors and to extend these findings across other dialect groups.

REFERENCES

Aaltonen, O., Niemi, P., Nyrke, T., & Tuhkanen, M. (1987). Event-related brain potentials and the perception of a phonetic continuum. *Biological Psychology*, *24*(3), 197-207.

Adger, C.T., Wolfram, W., & Christian, D. (2014). *Dialects in schools and communitie.* Routledge.

Agerton, E., & Moran, M. (1995). Effects of race and dialect of examiner on language samples elicited from southern African-American preschoolers. *Journal of Communication Disorders*, 16,25–30.

American Speech-Language-Hearing Association. "Highlights and Trends: Member and Affiliate Counts, Year-End 2014". Retrieved Jan. 3, 2016 http://www.asha.org/uploadedFiles/2014-Member-Counts-Year-End-Highlights.pdf

Asante, M.K. (1990). African Elements in African-American English. *Africanisms in American culture*, 19-33.

Baratz, S., & Baratz, J. (1970). Early childhood intervention: The social science base of institutional racism. *Harvard Educational Review*, *40*(1), 29-50.

Bain, B.A., & Olswang, L.B. (1995). Examining Readiness for Learning Two-Word Utterances by Children With Specific Expressive Language Impairment Dynamic Assessment Validation. *American Journal of Speech-Language Pathology*, *4*(1), 81-91.

Bernthal, J.E., Bankson, N.W., & Flipsen, P. (2012). *Articulation and phonological disorders: Speech sound disorders in children*. Pearson Higher Ed.

Bialystok, E., & Ryan, E. B. (1985). Toward a definition of metalinguistic skill. *Merrill Palmer Quarterly (1982-)*, 229-251.

Boas, F. (1940). *Race, language, and culture*. University of Chicago Press.

Boersma, P., & Weenink, D. (2005). Praat: doing phonetics by computer (Version 5.3.2). Retrieved September 8, 2012 from http://www.praat.org/.

Bowie, D. (2000). The effect of geographic mobility on the retention of a local dialect. (Doctoral dissertation) University of Pennsylvania.

Brooks-Gunn, J., & Duncan, G.J. (1997). The effects of poverty on children. *The future of children*, 55-71.

Brutt-Griffler, J. (2002). *World English: A study of its development* (Vol. 34). Clevedon, UK; Buffalo [N.Y.]; Multilingual Matters.

Buchwald, J. S., Guthrie, D., Schwafel, J., Erwin, R.J., & Van Lancker, D. (1994). Influence of language structure on brain- behavior development. *Brain and Language*, 46, 607–619.

Campbell, T., Dollaghan, C., Needleman, H., & Janosky, J. (1997). Reducing Bias in Language AssessmentProcessing-Dependent Measures. *Journal of Speech Language,*
and Hearing Research, *40*(3), 519-525.

Canagarajah, S. (2011). Codemeshing in academic writing: Identifying teachable strategies of translanguaging. *The Modern Language Journal*, *95*(3), 401-417.

Cassar, E.M. (2008). You Gotta Know the Rules to Break the Rules: Code-Switching & Attitudes on Language in an Urban Classroom. *Teachers Network Leadership Institute.*

Chen, L., Shu, H.U.A., Liu, Y., Zhao, J., & Li, P. (2007). ERP signatures of subject–verb agreement in L2 learning. *Bilingualism: Language and Cognition*, *10*(02), 161-174.

Cole, P.A., & Taylor, O.L. (1990). Performance of working class African-American children on three tests of articulation. *Language, Speech, and Hearing Services in Schools*, *21*(3), 171-176.

Collins, P., & Blair, D. (Eds.). (1989). *Australian English: The language of a new society*. University of Queensland Press.

Conrey, B., Potts, G. F., & Niedzielski, N.A. (2005). Effects of dialect on merger perception: ERP and behavioral correlates. *Brain and Language*, *95*(3), 435-449.

Coltheart, M. (1981). The MRC psycholinguistic database. *The Quarterly Journal of Experimental Psychology*, *33*(4), 497-505.

Craig, H.K., Thompson, C.A., Washington, J.A., & Potter, S.L. (2003). Phonological features of child African American English. *Journal of Speech, Language, and Hearing Research*, *46*(3), 623-635.

Craig, H. K., & Washington, J. A. (2004). Grade-related changes in the production of African American English. *Journal of Speech, Language & Hearing Research*, 47(2).

Dahl, Ö. (1985). *Tense and aspect systems*. New York: Basil Blackwell.

Dalby, D. (1972). The African Element in American English. *Rappin'and stylin'out: Communication in urban Black America*, 170-86.

Delpit, L. (1995). *Other people's children: Cultural conflict in the classroom*. New York: The New Press.

Dien, J., & Santuzzi, A.M. (2005). Application of repeated measures ANOVA to high-density ERP datasets: A review and tutorial. In T.C. Handy (Ed.), *Event related potentials: a methods handbook* (pp. 57-82). Cambridge, MA: The MIT Press.

Dillard, J. L. (1968). Non-Standard Negro Dialects-Convergence or Divergence? *The Florida Reporter*, *65*(2).

Dillard, J.L (1972) *Black English: Its history and usage in the US.* New York: Random House.

Eberhardt, M., & Freeman, K. (2015). 'First things first, I'm the realest': Linguistic appropriation, white privilege, and the hip hop persona of Iggy Azalea. *Journal of sociolinguistics*, *19*(3), 303-327.

Edwards, W. (1998). Sociolinguistic features of Rap lyrics: comparisons with Reggae. *Studies in Caribbean language*, *2*, 128-146.

Eviatar, Z., & Ibrahim, R. (2000). Bilingual is as bilingual does: Metalinguistic abilities of Arabic-speaking children. *Applied psycholinguistics*, *21*(04), 451-471.

Fagundes, D.D., Haynes, W.O., Haak, N.J., & Moran, M.J. (1998). Task variability effects on the language test performance of southern lower socioeconomic class African American and Caucasian five-year-olds. *Language, speech, and hearing services in schools*, *29*(3), 148-157.

Featherston, S., Gross, M., Münte, T.F., & Clahsen, H. (2000). Brain potentials in the processing of complex sentences: An ERP study of control and raising constructions. *Journal of psycholinguistic research*, *29*(2), 141-154.

Ferguson, C.A. (1959). Diglossia. *word*, *15*(2), 325-340.

Finegan, Edward (1980) *Attitudes toward English usage: The history of a war of words*. New York: Teachers College Press.

Francis, W., & Kucera, H. (1982). Frequency analysis of English usage [Database] Retrieved from http://www.psych.rl.ac.uk/.

Friederici, A. D. (2002). Towards a neural basis of auditory sentence processing. *Trends in cognitive sciences*, *6*(2), 78-84.

Garrity, A. W., & Oetting, J. B. (2010). Auxiliary BE Production by African American English–Speaking Children With and Without Specific Language Impairment. *Journal of Speech, Language, and Hearing Research*, *53*(5), 1307-1320.

Glazer, N., & Moynihan, D. P. (1963). Beyond the melting pot: The Negroes, Puerto Ricans, Jews, Italians and Irish of New York City. Oxford, England: Massachusetts Inst. Technology Press.

Gramley, S., & Pátzold, M. (2004). *A survey of modern English*. Routledge.

Gregory, M. (1967). Aspects of varieties differentiation. *Journal of Linguistics*, *3*(2), 177-198.

Hagoort, P. (2008). The fractionation of spoken language understanding by measuring electrical and magnetic brain signals. *Philosophical Transactions of the Royal Society of London B: Biological Sciences*, *363*(1493), 1055-1069.

Hagoort, P., Brown, C., & Groothusen, J. (1993). The syntactic positive shift (SPS) as an ERP measure of syntactic processing. *Language and cognitive processes*, *8*(4), 439- 483.

Hahne, A. (2001). What's different in second-language processing? Evidence from event-related brain potentials. *Journal of Psycholinguistic Research*, 30 (3): 251–256.

Hahne, A., & Friederici, A.D. (1999). Electrophysiological evidence for two steps in syntactic analysis: Early automatic and late controlled processes. *Journal of Cognitive Neuroscience*, 11, 193–204.

Hahne, A., & Friederici, A. D. (2001). Processing a second language: Late learners' comprehension mechanisms as revealed by event-related brain potentials. *Bilingualism: Language and Cognition*, *4*(02), 123-141.

Hahne, A., & Jescheniak, J.D. (2001). What's left if the Jabberwock gets the semantics? An ERP investigation into semantic and syntactic processes during auditory sentence comprehension. *Cognitive Brain Research*, 11, 199–212.

Handy, T. (Ed.). (2005). *Event-related potentials: A methods handbook.* Cambridge, Massachusetts: The MIT Press.

Harris, Y.R., & Graham, J.A. (2007). *The African American Child.* New York: Springer Publishing Company.

Harris, Y.R., & Schroeder, V.M. (2013). Language deficits or differences: What we know about African American Vernacular English in the 21st century. *International Education Studies*, *6*(4), 194–204.

Heller, K.A., Holtzman, W.H., & Messick, S. (Eds.). (1982). *Placing children in special education: A strategy for equity.* Washington, DC: National Academy Press.

Herskovits, M.J. (1990). *The myth of the Negro past*. Beacon Press.

Holloway, J.E., & Vass, W.K. (1993). *The African Heritage of American English*. Bloomington: Indiana University Press.

Hosp, J.L., & Reschly, D.J (2003). Referral rates for intervention or assessment: A meta-analysis of racial differences. *The Journal of Special Education*, 37(2), 67.

Isel, F., Hahne, A., & Friederici, A.D. (2000, September). Auditory processing of German sentences by French late bilinguals. In *Poster presented at the Conference of Architectures and Mechanisms of Language Processing (Amlap),* Leiden, The Netherlands.

Jackson, G. M., Swainson, R., Mullin, A., Cunnington, R., & Jackson, S.R. (2004). ERP correlates of a receptive language switching task. *Quarterly Journal of Experimental Psychology Section A*, *57*(2), 223-240.

Jackson, S. R., Jackson, G. M., & Roberts, M. (1999). The selection and suppression of action: ERP correlates of executive control in humans. *Neuroreport*, *10*(4), 861-865.

Jansma, B. M., Rodriguez-Fornells, A., Moller, J., & Munte, T.F. (2004). Electrophysiological studies of speech production. *Trends in Linguistic Studies and Monographs*, *157*, 361-396.

Jencks, C., & Phillips, M. (Eds.). (2011). *The black-white test score gap*. Brookings Institution Press.

Jenkins, J. (2000). *The phonology of English as an international language*. Oxford University Press.

Johnson, K.R. (1979). Teaching mainstream American English: Similarities and differences with speakers of Ebonics and speakers of foreign languages. *Journal of Black Studies*, 411-422.

Kaan, E. (2007). Event related potentials and language processing: A brief overview. *Language and Linguistics Compass*, *1*(6), 571-591.

Kaan, E., Harris, A., Gibson, E., & Holcomb, P. (2000). The P600 as an index of syntactic integration difficulty. *Language and cognitive processes*, *15*(2), 159-201.

Kachru, Y. (2006) World Englishes and language education. In Nero, Shondel J. (Ed). *Dialects, Englishes, Creoles and Education.* (pp. 19-37) New York, NY: Lawrence Erlbaum Associates, Inc.

Keating, D., & Schulte, B. (2001). Pupils' poverty drives achievement gap. *Washington Post*, A01.

Khamis-Dakwar, R., & Froud, K. (2007, February). Lexical Processing In Two Language Varieties`. In *Perspectives on Arabic Linguistics: Papers from the annual symposium on Arabic linguistics. Volume XX: Kalamazoo, Michigan, March 2006* (Vol. 290, p. 153). John Benjamins Publishing.

Kochman, T. (1981). *Black and white styles in conflict*. University of Chicago Press.

Kortmann, B., Schneider, E. W., Burridge, K., Mesthrie, R., & Upton, C. (2004). *A handbook of varieties of English: a multimedia reference tool*. Walter de Gruyter.

Kotz, S.A., Holcomb, P.J., & Osterhout, L. (2008). ERPs reveal comparable syntactic sentence processing in native and non-native readers of English. *Acta psychologica*, *128*(3), 514-527.

Kutas, M., & Federmeier, K.D. (2011). Thirty years and counting: Finding meaning in the N400 component of the event related brain potential (ERP). *Annual review of psychology*, *62*, 621.

Kutas, M. & Hillyard, S. A. (1980) Reading senseless sentences: brain potentials reflect semantic anomaly. *Science* 207, 203–205.

Labov, W. (1972). *Language in the inner city: Studies in the Black English vernacular* (Vol. 3). University of Pennsylvania Press.

Labov, W. (1972). *Sociolinguistic patterns* (No. 4). University of Pennsylvania Press.

Labov, W. (1996, October). The organization of dialect diversity in North America. In *Fourth International Conference on Spoken Language Processing*.

Labov, W. (2003). When ordinary children fail to read. *Reading Research Quarterly*, *38*(1), 128-131.

Labov, W., Cohen, P., Robins, C., & Lewis, J. (1968). A study of the non-standard English of Negro and Puerto Rican speakers in New York City. Final Report, *Cooperative Research Project*, No. 3288. Washington, DC: US Office of Education.

Labov, W., & Harris, W.A. (1986). De facto segregation of black and white vernaculars. *Diversity and diachrony*, *53*, 33-44.

Labov, W., Karan, M., & Miller, C. (1991). Near-mergers and the suspension of phonemic contrast. *Language Variation and Change*, 3, 33–74

Ladefoged, P. (1968). *A phonetic study of West African languages: An auditory-instrumental survey* (No. 1). Cambridge University Press.

Lantz, G., de Peralta, R.G., Spinelli, L., Seeck, M., & Michel, C.M. (2003). Epileptic source localization with high density EEG: how many electrodes are needed? *Clinical neurophysiology*, *114*(1), 63-69.

Leikin, M. (2008). Syntactic processing in two languages by native and bilingual adult readers: An ERP study. *Journal of Neurolinguistics*, *21*(4), 349-373.

LeMoine, N. (2007) *Teachers guide to supporting African American Standard English learners: Understanding the characteristic linguistic features of African American language as contracted with standard English structure* [PowerPoint slides] Retrieved from http://achieve.lausd.net/Page/192

Lidz, C.S., & Pena, E.D. (1996). Dynamic Assessment: The model, its relevance as a nonbiased approach, and its application to Latino American preschool children. *Language, Speech, and Hearing Services in Schools*, *27*(4), 367-372.

Lucas, C., & Borders, D. (1994). *Language diversity in classroom discourse*. Norwood, NJ: Ablex Publishing.

Luck, S. J. (2005). *An introduction to the event-related potential technique*. Cambridge, Mass: MIT Press.

Luu, P., Tucker, D. M., Englander, R., Lockfeld, A., Lutsep, H., & Oken, B. (2001). Localizing acute stroke-related EEG Changes:: Assessing the effects of spatial undersampling. *Journal of Clinical Neurophysiology*, *18*(4), 302-317.

MacWhinney, B. (1997). Second language acquisition and the competition model. *Tutorials in bilingualism: Psycholinguistic perspectives*, 113-142.

Marçais, W. (1930-31). La diglossie arabe. La languae arabe dans L'Affique de Nord, etc. L'En- seignement Public, 97:401-09; 105:20-39, 121-33.

Mazzoni, D. (2008): Audacity (Version 2.0.5.0) [Computer program]. Retrieved October 18, 2013, from http://audacity.sourceforge.net/.

Melchers, G., & Shaw, P. (2013). *World Englishes*. Routledge.

Mencken, H. L. (1936) *The American Language: Three Volumes*. Knopf. New York, NY.

Meuter, R. & Allport, A. 1999. Bilingual Language Switching in Naming: Asymmetrical costs of language selection. *Journal of Memory and Language*, 40, 25-40.

Milroy, L., & Muysken, P. (1995). *One speaker, two languages: Cross-disciplinary perspectives on code-switching*. Cambridge University Press.

Moreno, E. M., Federmeier, K. D., & Kutas, M. (2002). Switching languages, switching palabras (words): An electrophysiological study of code switching. *Brain and language*, *80*(2), 188-207.

Moreno, E. M., Rodríguez-Fornells, A., & Laine, M. (2008). Event-related potentials (ERPs) in the study of bilingual language processing. *Journal of Neurolinguistics*, *21*(6), 477-508.

Morgan, M. (1994). Theories and politics in African American English. *Annual Review of Anthropology*, 325-345.

Muysken, P. (1995). Code-switching and grammatical theory. In L. Milroy & P. Muysken (Eds). *One Speaker, Two Languages: Cross-disciplinary Perspectives on Code-switching*. Cambridge: Cambridge University Press. pp. 177–98

Näätänen, R., Lehtokoski, A., Lennest, M., Luuki, A., Alliki, J., Sinkkonen, J., & Alho, K. (1997). Language-specific phoneme representations revealed by electric and magnetic brain responses. *Nature*, *385*, 432-434.

Näätänen, R., Paavilainen, P., Rinne, T., & Alho, K. (2007). The mismatch negativity (MMN) in basic research of central auditory processing: A review. *Clinical Neurophysiology*, *118*(12), 2544-2590.

Nakagome, K., Takazawa, S., Kanno, O., Hagiwara, H., Nakajima, H., Itoh, K., & Koshida, I. (2001). A topographical study of ERP correlates of semantic and syntactic violations in the Japanese language using the multichannel EEG system. *Psychophysiology*, *38*(02), 304-315.

National Assessment of Education Progress (2016). *NAEP Data Explorer* [Data file] Retrieved January 3, 2016. http://nces.ed.gov/nationsreportcard/naepdata/dataset.aspx

National Center for Education Statistics (2014). "Children and Youth with Disabilities." Retrieved January 3, 2016 http://nces.ed.gov/programs/digest/d14/tables/dt14_204.50.asp

Nero, S. J. (Ed.). (2012). *Dialects, Englishes, creoles, and education*. Routledge.

Neville, H., Nicol, J.L., Barss, A., Forster, K.I., & Garrett, M.F. (1991). Syntactically based sentence processing classes: Evidence from event-related brain potentials. *Journal of cognitive Neuroscience*, *3*(2), 151-165.

Oetting, J. (2014). Language impairment in children who speak Nonmainstream dialects. Retrieved from http://cred.pubs.asha.org/article.aspx?articleid=2442990

Oetting, J. B., & McDonald, J. L. (2002). Methods for characterizing participants nonmainstream dialect use in child language research. *Journal of Speech, Language, and Hearing Research*, *45*(3), 505-518.

Ogbu, J.U. (2003). *Black American students in an affluent suburb: A study of academic disengagement*. Routledge.

O'Grady, W., Archibald, J., Aronoff, M. & Rees-Miller, J. (2001) *Contemporary Linguistics* (4th Ed). Bedford/St.Martins.

Ojima, S., Nakata, H., & Kakigi, R. (2005). An ERP study of second language learning after childhood: Effects of proficiency. *Journal of Cognitive Neuroscience, 17*(8), 1212-1228.

Öllinger, M. (2009). EEG and Thinking. In *Neural correlates of thinking* (pp. 65-82). Springer Berlin Heidelberg.

Olness, G.S., Matteson, S.E., & Stewart, C.T. (2010). "Let me tell you the point": How speakers with aphasia assign prominence to information in narratives. *Aphasiology*, *24*(6-8), 697-708.

Osterhout, L., Holcomb, P. J., & Swinney, D. A. (1994). Brain potentials elicited by garden-path sentences: evidence of the application of verb information during parsing. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *20*(4), 786.

Paradis, M. (1985). On the representation of two languages in one brain. *Language Sciences*, *7*(1), 1-39.

Paradis, M. (2004). *A neurolinguistic theory of bilingualism* (Vol. 18). John Benjamins Publishing.

Paradis, J., Nicoladis, E., & Genesee, F. (2000). Early emergence of structural constraints on code-mixing: Evidence from French–English bilingual children. *Bilingualism: Language and Cognition*, *3*(03), 245-261.

Patel, A. X., Gibson, E., Ratner, J., Besson, M., & Holcomb, P. J. (1998). Processing syntactic relations in language and music: An event-related potential study. *Journal of Cognitive Neuroscience, 10*(6), 717-733.

Pfaff, C. W. (1979). Constraints on language mixing: intrasentential code-switching and borrowing in Spanish/English. *Language*, 291-318.

Phillips, M. (Ed.). (2011). *The Black-White test score gap*. Brookings Institution Press.

Picton, T.W., Bentin, S., Berg, P., Donchin, E., Hillyard, S.A., Johnson, R., Taylor, M.J. (2000). Guidelines for using human event related potentials to study cognition: Recording standards and publication criteria. *Psychophysiology, 37*(2), 127-152.

Pizzagalli, D.A. (2007). Electroencephalography and high-density electrophysiological source localization. *Handbook of psychophysiology*, *3*, 56-84.

Poplack, S., & Sankoff, D. (1984). Borrowing: the synchrony of integration. *Linguistics*, *22*(1), 99-136.

Proverbio, A.M., Leoni, G., & Zani, A. (2004). Language switching mechanisms in simultaneous interpreters: an ERP study. *Neuropsychologia*, *42*(12), 1636-1656.

Proctor, B.D., Semega J.L., Kollar M.A. (2016) Income and Poverty in the United States: 2015. *US Census Bureau, Current Population Reports, 60-256*. Washington, DC: US Government Printing Office.

Ratusnik, D., & Koenigsknecht, R. (1975). Influence of certain clinical variables on black preschoolers' non-standard phonological and grammatical performance. *Journal of Communication Disorders*, 8, 281–297.

Reveron, W. (1978). The acquisition of four Black English morphological rules by black preschool children. (Unpublished doctoral dissertation). Ohio State University, Columbus, OH.

Rickford, J. (1979). Variation in a creole continuum: Quantitative and implicational approaches. (Unpublished doctoral dissertation), University of Pennsylvania, PA.

Rickford, J. R. (1999). *African american vernacular english: Features, evolution, educational implications*. Malden, Mass: Blackwell Publishers.

Rickford, J. & McNair-Knox, F. (1999). Addressee and topic influenced style shift: a quantitative sociolinguistic study. In J. Rickford (Ed.), African American vernacular English. Malden, MA: Blackwell Publishing.

Rivera-Gaxiola, M., Csibra, G., Johnson, M. H., & Karmiloff-Smith, A. (2000). Electrophysiological correlates of cross-linguistic speech perception in native English speakers. *Behavioural Brain Research*, 111(1–2), 13–23.

Rodekohr, R. K., & Haynes, W. O. (2001). Differentiating dialect from disorder: A comparison of two processing tasks and a standardized language test. *Journal of Communication Disorders*, *34*(3), 255-272.

Rodriguez-Fornells, A., Rotte, M., Heinze, H. J., Nösselt, T., & Münte, T. F. (2002). Brain potential and functional MRI evidence for how to handle two languages with one brain. *Nature*, *415*(6875), 1026-1029.

Rodriguez-Fornells, A., Van Der Lugt, A., Rotte, M., Britti, B., Heinze, H. J., & Münte, T. F. (2005). Second language interferes with word production in fluent bilinguals: brain potential and functional imaging evidence. *Journal of Cognitive Neuroscience*, *17*(3), 422-433.

Rossi, S., Gugler, M. F., Friederici, A. D., & Hahne, A. (2006). The impact of proficiency on syntactic second-language processing of German and Italian: Evidence from event- related potentials. *Cognitive Neuroscience, Journal of*, *18*(12), 2030-2048.

Rugg, M. D. & Coles, M. G. H. (Eds.). (1995). *Electrophysiology of Mind: Event-Related Brain Potentials and Cognition.* Oxford: Oxford University Press.

Saiegh-Haddad, E., & Henkin-Roitfarb, R. (2014). The Structure of Arabic Language and Orthography. In E. Saiegh-Haddad, & M. Joshi (Eds.), *Handbook of Arabic Literacy: Insights and Perspectives* (pp. 3-28). Dordrecht: Springer.

Sankoff, D. (Ed.). (1986). *Diversity and diachrony* (Vol. 53). John Benjamins Publishing.

Scotton, C. (1993). *Duelling languages: grammatical structure in codeswitching.* Oxford, Eng.: Clarendon Press.

Seymour, H.N., Bland-Stewart, L., & Green, L.J. (1998). Difference versus deficit in child African American English. *Language, Speech, and Hearing Services in Schools*, *29*(2), 96-108.

Siegel, Jeff (2006) Keeping creoles and dialects out of the classroom: Is it justified? In S. J. Nero (Ed.), *Dialects, Englishes, Creoles, and Education* (pp. 39-65). New York, NY: Lawrence Erlbaum Associates.

Singson, M., Mahony, D., & Mann, V. (2000). The relation between reading ability and morphological skills: Evidence from derivational suffixes. *Reading and writing*, *12*(3), 219-252.

Smitherman, G. (1977). *Talkin and Testifyin: The Language of Black America*. Boston: Houghton Mifflin Company.

Snow, C. E. (1990). Rationales for native language instruction. *Bilingual education: Issues and strategies*, 60-74.

Song, J., Davey, C., Poulsen, C., Luu, P., Turovets, S., Anderson, E., & Tucker, D. (2015). EEG source localization: Sensor density and head surface coverage. *Journal of Neuroscience Methods*, *256*, 9-21.

Spears, A.K., (1987). Are Black and White vernaculars diverging? Papers from the NWAVE XIV panel discussion. *American Speech*, *62*(1), 3-80.

Stewart, W.A. (1967). *Sociolinguistic factors in the history of American Negro dialects*. Peter Lang Publishing, Inc. New York, NY.

Stewart, W.A. (1968). Continuity and Change in American Negro Dialects. *Florida Report*. 5:11.

Stewart, W.A. (1969). Historical and structural bases for the recognition of Negro dialect. *Georgetown University Round Table on Languages and Linguistics*, 239-247.

Stockman, I.J., Boult, J., & Robinson, G.C. (2008). Multicultural/multilingual instruction in educational programs: A survey of perceived faculty practices and outcomes. *American Journal of Speech-Language Pathology*, *17*(3), 241-264.

Stowe, L.A., & Sabourin, L. (2005). Imaging the processing of a second language: Effects of maturation and proficiency on the neural processes involved. *International Review of Applied Linguistics in Language Teaching*, *43*(4), 329-353.

Strevens, P. (1981). What Is 'Standard English' ?. *RELC Journal*, *12*(2), 1-9.

Swaab, T.Y., Ledoux, K., Camblin, C.C., & Boudewyn, M.A. (2012). Language-related ERP components. *Oxford handbook of event-related potential components*, 397-440.

Tucker, D. M. (1993). Spatial sampling of head electrical fields: the geodesic sensor net. *Electroencephalography and clinical neurophysiology*, *87*(3), 154-163.

Trawick-Smith, B. (2011) *The American Accents.* [Data file] Retrieved from http://dialectblog.com/northamerican-accents/

Ukrainetz, T.A., Harpell, S., Walsh, C., & Coyle, C. (2000). A preliminary investigation of dynamic assessment with Native American kindergartners. *Language, Speech, and Hearing Services in Schools*, *31*(2), 142-154.

Ulatowska, H.K., & Olness, G.S. (2003). On the nature of direct speech in narrative of African Americans with aphasia. *Brain and Language*, *87*(1), 69-70.

Ulatowska, H., Olness, G., Keebler, M., & Tillery, J. (2006). Evaluation in stroke narratives: A study in aphasia. *Brain and Language*, *99*(1), 61-62.

U.S. Department of Education. (1992-2013) National Assessment of Educational Progress [Data file] Retrieved from https://nces.ed.gov/nationsreportcard/reading/

Van Heuven, W. J., Mandera, P., Keuleers, E., & Brysbaert, M. (2014). SUBTLEX-UK: A new and improved word frequency database for British English. [Data base] *The Quarterly Journal of Experimental Psychology*, *67*(6), 1176-1190.

Washington, J., & Craig, H. (1998). Socioeconomic status and gender influences on children's dialectal variations. *Journal of Speech and Hearing Research*, 41 (3), 618–627.

Washington, J., Craig, H., & Kushmal, A. (1998). Variable use of African-American English across two language-sampling contexts. *Journal of Speech and Hearing Research*, 41 (5), 1115–1124.

Weber-Fox, C., & Neville, H. (1996). Maturational constraints on functional specializations for language processing: ERP and behavioral evidence in bilingual speakers. *Journal of Cognitive Neuroscience, 8*(3), 231-256.

Willis, W. (2004). Families with African American Roots. In Lynch, E. & Hanson, M. (Eds.), *Developing Cross-Cultural Competence* (3rd Edition, pp.141-178). Baltimore, MD: Paul Brooks.

Wolfram, W. (1969). A Sociolinguistic Description of Detroit Negro Speech. Washington DC: Cent. *Appl. Linguist*.

Wolfram, W. (1991). *Dialects and American English*. Prentice Hall.

Wolfram,W., Adger, C. T., & Christian, D. (1999). *Dialects in schools and communities.* Mahwah, NJ: Erlbaum Publishers.

Wolfram, W., & Schilling-Estes, N. (, 1998, 2005, 2015). *American English: dialects and variation* (Vol. 20). Wiley-Blackwell.

Wolfram, W., & Thomas, E. (2008). *Development of African American English*. John Wiley & Sons.

Wood, S. (2005). Praat for beginners [Software Manual]. Retrieved September 8, 2012 Retrieved from http://www.ling.lu.se/persons/Sidney/praate/.

Wulfeck, B., Juarez, L., Bates, E., & Kilborn, K. (1986). Sentence interpretation strategies in healthy and aphasic bilingual adults. *Language processing in bilinguals: Psycholinguistic and neuropsychological perspectives*, 199-219.

Wyatt, T. A. (1995). Language development in African American English child speech, *Linguistics and Education*, *7*(1), 7-2.

Young, V. A., Barrett, R., & Lovejoy, K. B. (2013). *Other people's English: Code-meshing, code-switching, and African American literacy*. Teachers College Press.

APPENDIX A

<u>Demographic & Language Background Questionnaire</u>

Date: **Race**:
Age: **Ethnicity**:
Gender: Male / Female / Trans / Other:

1. I consider my childhood socioeconomic income status as most closely resembling*:

a. Poverty
b. Working Class
c. Lower Middle
d. Middle
e. Upper Middle
f. Upper
g. I don't know / I would rather not say.

2. As a child, I was raised in a family with an average total income most closely resembling the following bracket*:

a. $23,050 or less
b. $23,050 - $32,500
c. $32,500 - $60,000
d. $60,000 - $100,000
e. $100,000 - $150,000
f. <$150,000
g. I don't know / I would rather not say

3. I consider my current socioeconomic income status as most closely resembling*:

a. Poverty
b. Working Class
c. Lower Middle
d. Middle
e. Upper Middle
f. Upper
g. I don't know / I would rather not say.

4. As an adult, my income bracket most closely resembles the following level*:

a. $23,050 or less
b. $23,050 - $32,500
c. $32,500 - $60,000
d. $60,000 - $100,000
e. $100,000 - $150,000
f. <$150,000)
g. I don't know / I would rather not say

*Income groups defined by the U.S. Census 2012, as described in this article: http://bit.ly/23SQnnP

5. What is your highest level of education started? (Please also list any diplomas, degrees, vocational license, certificates, etc.):

6. What is your current occupation?

7. Are you right or left handed? (Please report your laterality index and right/left decile from online questionnaire)

8. Any history of any of the following? (Write 'yes' if so.)
- Speech or language disorder?
- Reading impairment/disability?
- Attention deficit disorder?
- Neurological condition (e.g., epilepsy, schizophrenia, depression)?
- Vision deficit?
- Deaf or Hard of Hearing?
- Use of medication? Please indicate type:
- Other: ___

9. What languages do you speak?

10. Which languages have you been exposed to?

11. What city (cities) did you live in from the ages of 0-15?

12. What neighborhood(s)?

In the United States, individual speakers of English may speak different regional dialects depending on geographic location and cultural background. Language research has embraced the study of this rich diversity only in recent years, and has recognized the importance of all English dialects as equal linguistic systems. These conclusions have influenced our nation's educational system for the better. We hope our study will continue to contribute to this research.

Current research in language and literacy has been expanded to include non-mainstream American English (NMAE) dialects other than AAE such as Southern American English, Creole English, Appalachian English, and Latino English (Terry et al, 2010).

The following questions are meant to get a clearer picture of each participant's unique language background.

13. That you know of, what English dialects do you speak or have you been exposed to? (Mark all that apply)
- African American English
- Standard American English
- Southern English
- Chicano-American English (Mexican English)
- Canadian English
- Spanish-Influenced English
- Appalachian English
- Other non-mainstream English: ________

APPENDIX B

Debriefing Questions

1. Did any of the experimental stimuli resemble a particular dialect of English?
2. How was your experience during this experiment?
3. Did anything about the sentences sound interesting to you? If so, what?
4. Did you use any strategies while making your decisions about each sentence?
5. Did you ever feel confused during the experiment? Which part?

APPENDIX C

Block 1 Stimuli

1	The	fat	aunt	sweep/s ⌘	the	room
2	The	black	cat	lap/s	the	milk
3	The	pink	pig	take/s *⌘	the	food
4	The	sly	dog	track/s	the	scent
5	The	old	man	fight/s	the	boy
6	The	slow	friend	pack/s	the	bag
7	The	slow	chef	cook/s	the	pie
8	The	rich	cook	chop/s	the	pear
9	The	sick	cow	eat/s	the	grass
10	The	thin	monk	write/s *	the	book
11	The	big	maid	tap/s	the	desk
12	The	mad	wife	break/s	the	cup
13	The	short	teen	kick/s	the	ball
14	The	cute	kid	pop/s	the	gum
15	The	shy	niece	make/s *⌘	the	speech
16	The	smart	clerk	wrap/s⌘	the	box
17	The	wet	mop	wipe/s⌘	the	floor
18	The	sweet	girl	pick/s	the	rose
19	The	strong	dad	rake/s⌘	the	leaves
20	The	young	child	light/s *	the	fire
21	The	small	son	lick/s⌘	the	spoon

* In the Kucera-Francis corpus accessed via the MRC Psycholinguistic Database, all the target verbs in Experiment 1 are below 100, with exception of these 5 words asterisked above, which were included for increased trials (Francis & Kucera, 1982; Coltheart, 1981).

⌘ In Brown's verbal frequency corpus accessed via the MRC Psycholinguistic Database, 8 of the target verbs did not appear in the corpus, and 2 were above 100 as noted above (Francis & Kucera, 1982; Coltheart, 1981).

Note: In the SUBTLEX-US corpus, the target verbs in Experiment 1 include nine words below 1000, five words from 1000-5k, two from 5k-10k, five from 10k-20k and two over 20k (Van Heuven, Mandera, Keuleers, & Brysbaert, 2014).

APPENDIX D

Block 2 Stimuli

1	The	anxious	bridesmaid	hurries	them/they	to	the	altar.
2	The	clever	student	prepares	her/she	for	the	exam.
3	The	pretty	lady	awaits	him/he	at	the	lobby
4	The	clever	student	prepares	her/she	for	the	exam.
5	The	healthy	jogger	outruns	them/they	at	the	racetrack.
6	The	angry	boatman	commands	him/he	to	the	engine.
7	The	bankrupt	chairman	receives	us/we	in	the	office.
8	The	sneaky	actor	admits	her/she	from	the	side door
9	The	massive	awning	protects	us/we	from	the	downpour.
10	The	cheery	sophomore	welcomes	him/he	to	the	clubhouse.
11	The	greedy	woman	marries	him/he	for	the	money.
12	The	bossy	grandchild	orders	her/she	to	the	playground.
13	The	gentle	doctor	comforts	them/they	in	the	clinic.
14	The	busy	lawyer	escapes	them/they	in	the	bathroom.
15	The	eager	puppy	follows	us/we	to	the	kitchen.
16	The	cranky	baby	distracts	her/she	from	the	party.
17	The	bloody	patient	infects	them/they	with	the	disease.
18	The	awkward	husband	questions	him/he	at	the	driveway.
19	The	brunette	diva	annoys	us/we	in	the	movie.
20	The	muscly	climber	carries	her/she	down	the	mountain.
21	The	distant	fire	reaches	them/they	in	the	morning.
22	The	wity	mayor	persuades	him/he	at	the	debate.
23	The	foreign	buyer	outbids	her/she	at	the	auction.
24	The	wild	artist	blindfolds	them/they	at	the	concert.
25	The	bitter	actress	applauds	him/he	for	the	award.
26	The	absent	grandson	avoids	them/they	in	the	attic.
27	The	crafty	gambler	swindles	him/he	at	the	tavern.
28	The	agile	gymnast	baffles	them/they	at	the	circus.
29	The	handsome	linguist	bothers	her/she	at	the	lecture.
30	The	able	midwife	nurtures	her/she	at	the	birthing.
31	The	deadly	fighter	attacks	him/he	in	the	alley.
32	The	friendly	beagle	cuddles	us/we	on	the	sofa.
33	The	quiet	inmate	tattoos	him/he	in	the	prison.

APPENDIX E

TEACHERS COLLEGE
COLUMBIA UNIVERSITY

Teachers College IRB *Expedited Approval Notification*

To: Felicidad Garcia
From: Cristy McGoff
Subject: IRB Approval: 16-429 Protocol
Date: 07/29/2016

Please be informed that as of the date of this letter, the Institutional Review Board for the Protection of Human Subjects at Teachers College, Columbia University has given full approval to your study, entitled "*Brain responses to contrastive and noncontrastive morphosyntactic structures in African American English and Mainstream American English: ERP evidence for the neural indices of dialect* ," under **Expedited Review** (Category **(4) Collection of data through noninvasive procedures**) on 07/29/2016.

The approval is effective until **07/28/2017**.

The IRB Committee must be contacted if there are any changes to the protocol during this period. **Please note:** If you are planning to continue your study, a Continuing Review report must be submitted to either close the protocol or request permission to continue for another year. Please submit your report by **06/30/2017** so that the IRB has time to review and approve your report if you wish to continue your study. The IRB number assigned to your protocol is **16-429**. Feel free to contact the IRB Office (212-678-4105 or cmcgoff@mail.com) if you have any questions.

Please note that your Consent form bears an official IRB authorization stamp and is attached to this email. Copies of this form with the IRB stamp must be used for your research work. Further, all research recruitment materials must include the study's IRB-approved protocol number. You can retrieve a PDF copy of this approval letter as well as the stamped consent(s) and recruitment materials from the IRB Mentor site.

When your study ends, please visit the IRB Mentor site. Go to the Continuing Review tab and select "terminate" from the drop-down menu.

Best wishes for your research work.

Sincerely,
Cristy McGoff

cmcgoff@mail.com

Attachments:
- Attachment6-Consent-ParticipantRights.pdf

APPENDIX F

Page 1

TEACHERS COLLEGE
Neurocognition of Language Lab, Department of Biobehavioral Sciences
525 West 120th Street, New York, NY 10027
Tel. 212 678 8158 · Email ndlab@tc.columbia.edu · Web www.tc.edu/neurocog

INFORMED CONSENT

DESCRIPTION OF THE RESEARCH: You are invited to take part in a neurolinguistic research study investigating American English dialect. You have been asked to take part because you are a monolingual English speaker of Anglo American or African American ethnicity.

PROCEDURES: In this research project, you will be asked to come to the Neurocognition of Language Laboratory for one session, which includes the completion of a Demographic & Language Background Questionnaire and participation in a brain experiment. Today, if you want to take part, we will ask you to be in the lab for 1.5 to 2 hours to complete this session.

To record your brain data, we use a method called electroencephalography (EEG), which involves the following steps. Your head size will be measured and you will have a "net" placed on your head. The net contains sensors inside small sponges that sit directly on the scalp. The sponges are first soaked in a weak salt solution (potassium chloride) that helps pick up small electrical signals. The very small signals that tell us about brain activity are recorded through the sensors. The sensor nets are very safe, and are used around the world in research and clinical work. Once the net is placed on your head, it is connected to an amplifier and a computer, which are shielded to make sure they are safe. Then we measure how well each sensor is working. After this, the experiment can begin.

While we record EEG, you will be asked to sit in our sound-attenuated experiment room, which has padding on the walls to make it quiet. You will listen to sentences being played out of a speaker overhead and asked to be very still while you listen. You will be asked to press a button after each sentence to indicate if you find the sentence to be "acceptable" or "unacceptable." The whole EEG experiment takes around 25 minutes. You can take a break any time you need. At the end of the experiment, we will take the sensor net off your head, and, we will ask you a few questions about your experience. Then you will be finished with the session.

While we are recording your brain activity, we will use a video camera to monitor you from outside the room, and you will have a bell available, which you can ring if you need anything. This video is only used to make sure you are comfortable and to monitor how much you move during the recording.

Do you agree to be videoed during the experiment? Yes ☐ No ☐

The whole time you are in the lab, you will have lots of chances to ask us questions, and we will do our best to make sure you are always comfortable and know exactly what we are doing. Any time you want, you can stop the experiment. If you decide to stop, you can take a break and then carry on; or you can come back some other time; or you can just decide not to be in the study at all, and that will be fine.

The research will be conducted by Felicidad Garcia, who is a speech-language pathologist and a doctoral student. She will be supervised by Dr. Karen Froud, who is a professor at the university and director of the Neurocognition of Language Lab. All the research and data analysis takes place in the Neurocognition of Language Lab at Teachers College, Columbia University.

RISKS AND BENEFITS: There is always a risk when you agree to take part in research. For this study, one risk is that you might get bored or tired. We will make sure that you can take a break any time you want to.

When we record brain activity using our sensors, there is a small risk of electric shock. This risk is smaller than when you use a toaster or electric kettle at home. We keep this experiment very safe by using special equipment to isolate our recording equipment from the mains electricity, and by making sure that you are never connected to earth ground (which means that you cannot form part of an electrical circuit).

When we put the electrode net on your head, it is wet, which can be uncomfortable at first. We will keep you as comfortable as possible by using warm water, by providing towels to catch any drips, and by applying the sensors as quickly as possible.

There is also a small risk of being uncomfortable, or getting a skin irritation, from having the sensors placed on your head. We keep this risk very low by keeping our equipment very clean, and by using sensors wrapped in small sponges, so that they are softer a g a salt solution to soak the net, to be as gentle on the skin as possible.

Teachers College, Columbia University
Institutional Review Board
Protocol Number: 16-429
Consent Form Approved Until: 07/28/2017

If you feel uncomfortable or concerned with the net, the tasks, or any part of your time in the lab, please feel free to ask questions and talk to the experimenter. Any time during the experiment, you can stop and take a break. After a while, you might decide to carry on, and that is fine. If you do not want to continue, that is also fine. You can stop taking part in the study AT ANY TIME.

Taking part in this study will not be of benefit to you directly. We hope that the study will help us find out more about how American English dialects are represented in monolingual speakers of American English. We hope that this knowledge will one day help us better understand language processing overall.

COMPENSATION: There is a $30 cash compensation for taking part in this experiment. This will be paid at the end of the experiment after all activities are completed. If you cannot complete the experiment we will not be able to pay the compensation.

DATA STORAGE TO PROTECT CONFIDENTIALITY: Your privacy is VERY important to us, and we are extremely careful to protect your identity. Computer files will be stored on password-protected computers that can be accessed only by members of the research team. Data files are identified by numbers, not by names. The only place where your name and your identifying number will be stored together, is on this consent form. You will be given a copy of this form to keep, and the only other copy will be stored in a locked filing cabinet in the Lab.

When we report results from our studies (e.g. at meetings to discuss research, or in professional journals), we usually report results from many people together, as averages. We NEVER use names when reporting data. If you provide a copy of a brain scan, your identifying information will be removed and replaced with your participant ID number. The image will be locked in a filing cabinet in the lab and only the researchers will be able to see it.

TIME INVOLVEMENT: Your participation in this study will take 1.5 – 2 hours, or longer if you decide to go slower or take more breaks. This does not include travel time.

HOW WILL RESULTS BE USED: The results of the study will be used in Felicidad Garcia's doctoral dissertation. We will also write about the study for professional journals, and talk about it at professional and academic conferences.

CONSENT: Please sign below if you agree to take part in this study. By signing below, you agree that you have understood the nature of the study, and what you will be asked to do, and you agree to take part. Please ask questions any time if you are not sure.

I agree that I ____[Name] am willing to take part in this neurolinguistic research study investigating American English dialect.

I have had an opportunity to ask questions about the study, and I understand what is involved.

Signed: ____ Date (mm/dd/yyyy): ______//______//________

Please also sign the Participant's Rights form (attached).

Teachers College, Columbia University
Institutional Review Board
Protocol Number: 16-429
Consent Form Approved Until: 07/28/2017

Teachers College, Columbia University

PARTICIPANT'S RIGHTS

Principal Investigator: Felicidad García

Research: neurolinguistic research study investigating American English dialect

I have read and discussed the Research Description with the researcher. I have had the opportunity to ask questions about the purposes and procedures regarding this study.

- My participation in research is voluntary. I may refuse to participate or withdraw from participation at any time without jeopardy to future medical care, employment, student status or other entitlements.
- The researcher may withdraw me from the research at his/her professional discretion.
- If, during the course of the study, significant new information that has been developed becomes available which may relate to my willingness to continue to participate, the investigator will provide this information to me.
- Any information derived from the research project that personally identifies me will not be voluntarily released or disclosed without my separate consent, except as specifically required by law.
- If at any time I have any questions regarding the research or my participation, I can contact the principal investigator, Felicidad García, who will answer my questions. The investigator's phone number is (212) 678 8169.
- If at any time I have comments, or concerns regarding the conduct of the research or questions about my rights as a research subject, I should contact the Teachers College, Columbia University Institutional Review Board /IRB. The phone number for the IRB is (212) 678-4105. Or, I can write to the IRB at Teachers College, Columbia University, 525 W. 120th Street, New York, NY, 10027, Box 151.
- I should receive a copy of the Research Description and this Participant's Rights document.
- If video and/or audio-taping is part of this research, I ( ) consent to be video/audio-taped. I ( ) do NOT consent to being video/audio-taped. The written video and/or audio-taped materials will be viewed only by the principal investigator and members of the research team for the purposes of monitoring and artifact detection only.
- My signature means that I agree to participate in this study.

Signature: ____ Date:__________

Print Name: ________________________

Investigator's Verification of Explanation

I certify that I have carefully explained the purpose and nature of this research to ______________________________ (participant's name) in age-appropriate language. He/She has had the opportunity to discuss it with me in detail. I have answered all his/her questions and he/she provided the affirmative agreement (i.e. assent) to participate in this research.

Investigator's Signature: __________________________ Date: ____________

Teachers College, Columbia University
Institutional Review Board
Protocol Number: 16-429
Consent Form Approved Until: 07/28/2017