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The Influence Of Dialect On The Perception Of Final Consonant Voicing

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by

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Table of Contents

List of Tables

List of Figures

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ABSTRACT

Children at risk for reading problems also have difficulty perceiving critical differences in speech sounds (Breier et al., 2004; Edwards, Fox, & Rogers, 2003; de-Gelder & Vroomen, 1998). These children rely more heavily on context than the acoustic qualities of sound to facilitate word reading. Dialect use, such as African American English (AAE) may influence literacy development in similar ways. Dialect use has been shown to affect speech sound processing and can even result in spelling errors (Kohler, et al., in press). The purpose of this study is to determine if children who speak AAE process cues indicative of final consonant voicing differently than children who speak a more mainstream dialect of English.

Twenty-six typically developing children in grades K-2 who spoke either AAE or a more mainstream American English dialect participated. The speech stimuli consisted of nonsense productions of vowel + plosive consonant. These stimuli were systematically altered by changing the vowel and stop-gap closure duration simultaneously, which resulted in the final consonant changing from a voiced consonant, like “ib”, to a voiceless consonant, like “ip”. Two tasks were developed: a continuum task where the child had to indicate when the stimuli changed in voicing and a same-different task which involved determining if two stimuli were identical in voicing or not.

No significant differences between groups were found for dialect use or grade for the same/different task. In the continuum task, chi-square analyses revealed significant differences in response patterns attributable to dialect and grade. In addition, a significant consonant by speaker interaction was found for mean ratings. Correlations between mean continuum rating and phonological awareness composites were not significant.

In conclusion, it was evident that children who speak AAE present with differences in their perception of final consonants in VC nonsense syllables. This finding suggests the dialect speakers may be using different cues to make judgments regarding the speech signal, or that the speakers of AAE have a less mature ability to extract fine phonetic detail due to the influence of their dialect (Baran & Seymour, 1979). More research is warranted to determine the exact role that dialect plays.

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Chapter 1

Literature Review and Purpose

There is an ongoing concern for the development of literacy in the school age population. The profound need for literacy and other related skills is understandable. Despite intense efforts in the schools and through enrichment programs to facilitate literacy learning, there are many children who have difficulties with literacy development and continue to academically fall behind their school-age peers. Children all over the United States are not achieving age-appropriate academic skills (Farkas & Beron, 2004; Fishback & Baskin, 1991). More specifically to our line of research, children are not meeting age-appropriate reading levels (Report of the National Reading Panel, NICHD, 2000). Those children are a topic of research because failure to reach expected age reading level has severe impacts on the advanced language and literacy skills that determine future success.

Reading is a multi-faceted skill. It is evident that there are many processes involved in the development of reading (Fennel & Werker, 2003; Velluntino & Scanlon, 1987). Deficits in any of these areas could pose major threats to typical literacy development in children. Fundamental reading skills provide a backbone for the acquisition of advanced skills. For example, as children are developing in oral language, phonological skills become more advanced. The combination of these more advanced skills leads to a strong phonological base. In turn a child has access to higher-level literacy and language capabilities, such as reading.

For this study, it is also important to show the relationship between phonology, reading, and perception. Children who have reading difficulties have been found to have perceptual difficulties also. Research has shown that children with reading deficits have difficulty paying attention to the fine phonetic details of speech signals (Breier, Fletcher, Denton, & Gray, 2004; Edwards, Fox, & Rogers, 2002). During the processes of reading, these children rely more on context and less on phonology to extract the necessary information. In turn, they miss out on important phonetic information from the speech signal. Acquiring the basic level of phonological knowledge (i.e., phonetic distinctions) is essential in developing higher-level skills, such as reading. If these children are missing out on the early stages of phonological knowledge, it possibly puts them at risk for deficits at the higher-level stages of phonological awareness.

If these higher-level literacy and language skills are essential, what is happening to the populations that have difficulty developing these skills? More specifically, who are the populations that are missing out, and what can be done to intervene? There are several different reasons why children may be missing out on the essential skills. Perhaps a lack of phonological knowledge is the core deficit (Munson, Edwards, & Beckman, 2005). Perhaps it is due to hearing deficit, which is the case with hearing-impaired children or children and chronic middle ear infections (Nittrouer & Burton, 2005). There is also research to suggest that these deficits result from deficits at the perceptual level, which is the case with dyslexic individuals (Blomert, Mitterer, & Paffen, 2004). Hence, some children may be missing out on the development of the necessary phonological knowledge due to impoverished early experiences. Another possible influence on early experiences is the use of a non-standard dialect (Silliman, Bahr, Wilkinson, & Turner, 2002). Perhaps exposure to and use of a dialect influences the development of phonological knowledge.

One dialect-speaking population that draws attention in the United States is the African American population. Past and present research shows a major gap in achievement levels between this dialect-speaking population and their same aged peers (Farkas & Beron, 2004; Fishback & Baskin, 1991). While it is still a mystery why this gap is so persistent, it is clear that the gap begins to broaden at a very young age and is still apparent in academic scores of older students. According to the Report of the National Reading Panel (NICHD, 2000), regional dialectal variations are considered "moderator variables" (p. 2-31), meaning that dialect somehow contributes to the development of reading, but its exact role is still unknown. It is important to note, also, that speakers of dialect might experience trouble when reading because written forms taught in school are not indicative of AAE. A more standard dialect form is used. Therefore, they may have more difficulty processing the standard form of dialect used in written forms.

Some existing explanations for the Black-White achievement gap include poverty, classroom environments and attitudes towards schooling, and early family literacy practices (Craig & Washington, 2006; Evans, 2005; Snow, Burns, & Griffin, 1998). There has also been evidence to suggest that this gap is present very early in life. Farkas and Beron (2004) revealed that as early as 36 months, an oral vocabulary gap is already present related to both race and socioeconomic status (SES). It is therefore pertinent to find reasonable solutions that can be taken advantage of to lessen the achievement gap so that children are not destined for academic failure (Silliman, et al., 2002).

As mentioned before, literacy is one of the main areas where these children are falling behind. This poses a significant problem since reading skills are necessary for achievement in other academic areas. The focus of this research study is on a dialect-speaking population, and how processes involved in the development of literacy skills may be different in this population. This study considers dialect as one possible early experience that could interfere with the development of strong phonological base suitable for literacy acquisition.

Organization of the literature review is as follows. The first main section introduces the dialect of African American English (AAE) and its history. A discussion of phonological representations and how they may differ in speakers of dialect is next. Theories of phonological awareness are addressed, as well as their role in reading development. The link between dialect, phonological awareness and reading will then be explored. Finally the literature review closes with a summary of the problem.

Dialect

Based on the evidence that early experience has a significant impact on language development (Nittrouer & Burton, 2005), it is probable that there is a population of children whose acquisition of phonological awareness is impacted due the inclusion of a specific dialect during their early experiences. While acquisition of a dialect is not considered to be atypical development, children who speak a non-standard dialect may achieve aspects of phonological processing differently than speakers of Standard

American English (SAE) due to the characteristics of the dialect they speak (Seymour & Seymour, 1981). It is important to note that everyone speaks a variation of SAE.

The dialect that will be explored in this project is African American English (AAE). This dialect is of interest because of a continuous widening spread in the Black-White Achievement Gap. Research has indicated that the number of African American students that acquire basic levels in reading, science, and math is considerably lower than the number of Caucasian students who acquire the same skills (Farkas & Beron, 2004). This gap presents major concerns for the education of these students and those responsible for providing their education. A brief review of the history and influence of AAE will help in determining the relationship between AAE and reading skills.

History and Influence of African American English

Dialects are normal outcomes of language; however, their underlying role in language development is still somewhat undetermined. AAE specifically has been spoken for decades; however, it was not until the 1960s that research interest in this dialect increased (Green, 2002). It was at that time researchers became interested in finding patterns of the dialect in hopes to define it more accurately. There are still questions and speculations raised as to the origin of the dialect; however, the features and characteristics of the dialect are clearly defined and agreed on by several authors (Craig & Washington, 2006; Green, 2002; Pollock et al., 1998). Green (2002) reported that while AAE is continually changing, there are aspects of the dialect that are constant and have been present for a significant amount of time.

Features that are present in AAE can be characterized as lexical, syntactic, and phonological (Craig & Washington, 2006; Green, 2002; Pollock et al., 1998). An example of a lexical feature is using the lexical entry "-own-" to represent self and to use it as a qualifier, (e.g., He cooked his food *hisownself*.). Slang terms are also considered lexical features (e.g., *phat*: an adjective meaning "nice" or "good"). An example of a syntactical feature is the use of the habitual "*be*" (e.g., He *be* eating). An example of a phonological feature is replacing interdental fricatives with labiodental fricatives (e.g., "bath" becomes "baf"). Another phonological example is the devoicing of final consonants (e.g., "bad" becomes "bat"). It is necessary to identify the different features in order to determine how they might be affecting the phonological acquisition of children who speak the dialect.

Poplack (2000) suggests that AAE is one of the most widely spoken variations of SAE discussed in the sociolinguistic research, which is why it is so important to consider the effects of this dialect on reading and literacy skills. It is just as important to consider how the use of this dialect may affect the development of a child's phonological knowledge (Silliman et al., 2002). Phonological knowledge is an entity that can be broken down into smaller components and arranged in a hierarchy (Munson et al., 2005). The most basic level of phonological awareness exists at the perceptual level and it must be developed in order to acquire knowledge of higher-level phonological skills, like phonological awareness. How then do phonetic differences influence the development of phonological knowledge in dialect speakers?

Phonological Representations

The storing of language features into the lexicon is an intricate process. Research over the decades has concluded that our brains store phonological representations as a quick way to retrieve concepts when needed (Tunmer & Chapman, 1998). These representations are needed for both accurate perception and production. In order to retrieve lexical information and use it for other purposes, it is essential to form and store a complete representation of information. Munson, Edwards, and Beckman (2005) describe four different levels of knowledge that are necessary to achieve in order for the brain to receive a complete representation of information for storage. After the different types of knowledge are explored below, different hypotheses will be addressed that account for the storage of this knowledge into phonological representations.

Munson, Edwards, and Beckman (2005) suggest the following four different types of phonological knowledge: *perceptual knowledge* (understanding of acoustic and perceptual aspects of sounds)*, articulatory knowledge* (understanding of the placement, voicing, and manner of articulation of sounds)*, higher-level phonological knowledge* (understanding of how words are divided into sounds and how sounds are put together to make words)*, and social indexical knowledge* (understanding of how variations in production convey social identity). The first type, perceptual knowledge, is most important to our study. This type of knowledge includes the developmental changes that are present in children's perceptions of speech (i.e. knowing the difference between /s/ and /ʃ/ with auditory cues only). Munson et al. (2005) stated that this type of knowledge entails two different kinds of information. They are: "a) information about the fine-grained acoustic-perceptual characteristics of words", and "b) information about the categorical structure of sounds, to account for the blindness to within-category variability," (p. 192).

It would appear that the integrity of perceptual knowledge could influence other levels of phonological knowledge (Coady, Kluender, & Evans, 2005). While language development differs between young children and that of an adult (Munson & Babel, 2005, Nittrouer & Burton, 2005), the initial strategies that children use eventually develop into more sophisticated adult-like strategies. Research also has suggested that children have perceptual immaturity until possibly the age of ten (Edwards et al., 2002; Hazan & Barret, 2000; Nittrouer, 1992). If early experiences, such as hearing loss or socioeconomic status (SES), prevent children from full exposure to language, perceptual deficits may occur very early in the developmental process (Nittrouer, 2004).

To illustrate the importance of the four different types of phonological knowledge mentioned above, the following example was provided (Munson et al., 2005). Consider the words “cake” and “cage”. These words are both stored as lexical representations. Different aspects of the words are stored as different types of representations that can be organized into the following categories: articulatory representations, semantic representations, and acoustic/perceptual representations. All of these categories compose the phonological representation that must be retrieved in order to identify the target word. At the articulatory level, information regarding voice, manner, and placement is stored. At the acoustic/perceptual level, information regarding acoustical parameters, such as frequency and amplitude, is gathered. Once these different types of information are combined to form the lexical representation, the semantic representation is achieved if the child has been exposed to the word previously. All of these types of knowledge are needed to distinguish the two words as having separate semantic representations.

Showing the importance of phonological representations is a study by Gaskell and Marslen-Wilson (1998). They demonstrated that different strategies or codes are used to make judgments during the perception of speech. In a two-part study assessing the perception of words and non-words that have had various phonological changes, the researchers discovered that listeners perceived speech at an abstract level and that perception required phonological inference and lexical knowledge. Their study used the carrier phrase "*freight bearer*" in the following sentence," Luckily the ship was only a freight bearer." Each time the sentence was presented, different aspects of the carrier phrase changed each time. Some examples include *"frayp bearer", "frayp carrier", "prayp bearer", "prayp carrier", "freight bearer", "freight carrier", "preight bearer", and "preight carrier"*. The participants were asked to click on the computer screen when they heard the carrier phrase "*freight bearer*". Response times were recorded. They determined that listeners used phonological inferences when making judgments about speech signals. This is evident because the listeners were able to make judgments based on the surface form (i.e., "*freight bearer"*) to evaluate the meaning of the non-words (i.e., *"frayp bearer"*). The participants used high-level phonological skills to make judgments regarding these stimuli. Since their knowledge of phonology was more advanced, they were able to evaluate the meaning of non-words based on a correct phonological code or representation stored in their brain for the surface form. They suggested that phonological inference plays a large part in perceptual processing, however, this requires a developed phonological representation system.

While this storing process is rather involved, it is usually a natural developmental process if there are no interruptions or processing of ambiguous information. There are different theories that explain the process of storing these different types of information and to determine if these representation are deficient. First, a model representing two broad ways in which our brain stores information will be addressed (Storkel &

Morrisette, 2002). Then, three rather detailed theories will be described that serve as explanations to help speculate deficits that may occur prohibiting a proper storage of information into phonological representations.

Theories of Storage.

Spoken word processing, or the production and perception of language, depends greatly on the organization of lexical and phonological items in our brain. Fortunately, our brain usually systematically stores the needed information for easy retrieval. The storage compartments that hold the representations are referred to as neighborhoods. Lexical information is stored in different neighborhoods based on lexical or phonological similarities. Storkel & Morrisette (2002) used the example of the word “sit”. Words, such as “sip”, “hit”, “it”, “fit”, etc., are stored in the same general neighborhood as the word “sit” because they are phonologically similar. Words that are more frequent have a denser neighborhood because of the number of other words that are phonologically similar. Less common words, such as “these” have a sparse neighborhood because there are not many words that are phonologically similar to “these”.

Activating these neighborhoods, which contain the representations, is part of the process by which we perceive and produce speech. Without a pre-conceived knowledge of sounds and words that are developed into meaningful chunks of information, or representations, our brains have no way of processing what they hear, and no way of having the means to produce speech. Storing information in our brains is generally an automatic developmental function. There are, however, people who have more difficulty establishing well-defined lexical boundaries of phonological representations based on experiences. Hypotheses to speculate what happens when people have weakly developed phonological libraries will be discussed next.

Storage hypotheses. Three theories that account for deficits during the storing of phonological representations in our brains include the *segmentation hypothesis* (Brady, 1997; Fowler, 1991), the *lexical restructuring deficit hypothesis* (Metsala & Brown, 1998; Metsala & Walley, 1998), and *the distinctness hypothesis* (Elbro, 1996; Elbro, Borstrom, & Petersen, 1998). These three theories will receive further explanation in the following paragraphs.

The *segmentation hypothesis* attributes difficulties in phonemic access to "subtle" deficits in formulating, retrieving, and maintaining phonological representations and not only to retrieval problems. Fowler (1991) suggests that as children get older, they shift from comprehending lexical units as a unit to comprehending them as smaller, more individual segments. This shift is seen in the spoken example of "*come mere*" for *come here* (Silliman et al., 2002). The child may not realize this is two different words until they become older and are exposed to more lexical complexities.

The *lexical restructuring deficit hypothesis* focuses on the role of vocabulary size and sound familiarity. Metsala and Walley (1998) suggest that vocabulary development depends mostly on the neighborhood densities that are stored in the brain. Since neighborhoods are stored according to phonetic similarity, it is necessary that phonemic distinctions continually be made in order to gain a strong vocabulary. Three important results that may occur if these phonemic distinctions are not continually made: a) phonemic access deficits (retrieval), b) grapheme-phoneme relationship deficits (phonological awareness), and c) deficits in unfamiliar word recognition (decoding). All three of these possibilities are associated with poor phonological sensitivity.

The *distinctness hypothesis* attributes deficits in phonological representations to poor discrimination abilities. These distinctions refer to how phonemically different representations are to their neighbors (Elbro, 1996). Based on stress, coarticulation, and dialect features, a simple phrase has many variations that could result. Silliman et al., (2002) used the example of the phrase *"that's mine"*. Variations of this phrase that could result are: /dæs maɪn, ðæs maɪn, dæt maɪn, ðæt maɪn, dæ maɪn, ðæ maɪn/. Elbro (1996) states that children with deficits in distinction have overlapping phoneme boundaries that make it difficult to specify the desired variation. These underdeveloped boundaries make it difficult for the desired linguistic form to be achieved based on context. This theory is different from the others in that it suggests, in regards to neighboring phonemic representations, that word reading is impacted more by underdeveloped boundaries as opposed to difficulties with segmentations.

Effects of Altered Representations

These three theories suggest that it is possible for individuals to have under-specified phonological representations. Therefore it is necessary to determine how these representations become altered. Coady, Kluender, and Evans (2005) postulated that because speech perception and "representational facility" are hard to differentiate in research, problems in one area erroneously imply problems in the other area. Therefore, an immature ability to code phonological representations can be related to an immature ability to detect fine phonetic detail in speech information.

The following studies are perceptual studies that show how the phonological representation deficits of certain populations are related to early experiences. Several of these types of studies have shown that deficits in early language experiences can lead to delays in certain phonological processing abilities (Nittrouer, 1996; Nittrouer & Burton, 2005).

Speech perception in children as it relates to phonological awareness has an interesting connection. It is known that children have a less developed ability to perceive characteristics of speech sounds as compared to adults (Mayo, Scobbie, Hewlett, & Waters, 2003), and that children rely on different parameters of the speech signal to detect phonological changes (Hicks & Ohde, 2005). Their knowledge of fine phonetic detail is not as developed as adults because of the differences in exposure. In fact, to account for these differences, Nittrouer (1996) proposed the Developmental Weighting Shift hypothesis, which states children perceive different aspects of the acoustic signal as they become more aware of the native language. In another article, Nittrouer and Crowther (1998) stated that children pay particular attention to rapidly changing, more obvious phonetic differences. For example, children in their experiment used formant transitions to make judgments about individual words, whereas the adults used strategies that included more fine phonetic details. This shift represents the stages of developmental maturity that occur when individuals learn to detect advanced acoustic signals as the phonetic knowledge of the native language increases.

It is possible that certain populations may be more at risk than others for a delay in acquiring phonological sensitivity due to a possible deficit in perceptual abilities. These populations include the hearing impaired (Leybaert, 1998; Mody, Schwartz, Gravel, & Ruben, 1999; Nittrouer & Burton, 2005), children at risk for reading impairment (Blomert et al., 2004), children with specific language impairment (SLI; Burlingame, Sussman, Gillam, & Hay, 2005; Coady et al., 2005), children with dyslexia (Godfrey, Syrdal-Lasky, Millay, & Knox, 1981), and possibly dialect speakers due to the phonological features of the dialect (Green, 2002). While not much research has been done on the latter condition, the other conditions will be discussed below.

Nittrouer and Burton (2005) studied the effects of early experiences on the perception of speech. They described the process that occurs in order to store lexical information. During this process, children rely on perceptual weighting strategies in order to gain access to lexical information. These weighting strategies are clues from the signal that help the child differentiate phonemes. As children’s knowledge of the language matures, they use different weighting strategies to make judgments about their perceptions. Nittrouer and Burton were interested in seeing how this natural process was affected when the early experiences were diminished. In order to do this, they tested the adverse effects of otitis media with effusion (OME) and SES on perception. Four and five year old subjects were placed into one of four groups. The groups were the low SES group, the OME group, the both (low SES and OME) group, and the control group. Using a variety of different phonological processing tasks, the researchers demonstrated how early experiences could affect speech perception and other skills, such as verbal working memory and temporal processing. They concluded that early experiences did indeed affect the development of language capabilities. Those children with chronic OME and low SES showed less accurate knowledge of weighting strategies than children without these two conditions.

These findings present a great groundwork for the reasons why children who have impoverished early experiences miss out on certain phonological information that is necessary for the development of more advanced language abilities. Nittrouer and Burton (2005), explained that these "…deficits interfere with the learning of language-specific perceptual strategies for speech. Being delayed in the acquisition of appropriate strategies for speech perception are related to delays in gaining access to phonetic structure, and those delays appear to affect (negatively) the abilities of children to store and retrieve language in working memory" (p. 54). Since children with perceptual deficits have difficulties recognizing the phonetic structure of words, their ability to store information regarding phonology is impacted, which, in turn creates delays in more advanced skills, such as decoding complex syntax.

Another study that showed the effects of perception on phonological awareness is Rvachew (2006). During a longitudinal study, the author explored the relationship between vocabulary, articulation, and perception as predictor variables and their effects on the outcome variable, phonological awareness. For the purposes of this study, the perceptual relationship is the focus. An important correlation mentioned in the article is that abilities in perception reflect the preciseness of acoustic-phonetic representations that the child stores in his/her brain. The researcher looked at perception of correctly and incorrectly produced words as a pre-kindergarten skill in children with speech/sound disorders. Later, she assessed the phonological awareness abilities of the same children when they were leaving kindergarten. The following relationships were determined from the study: 1) speech perception skills were associated with improvements in phonological awareness and 2) speech perception had an impact on speech production, or articulation accuracy. In conclusion, this study showed that perception in 4-year-olds is associated with later development of phonological awareness in kindergarten-aged children.

Yet another study showing the relationship between perception and phonological awareness is Edwards, Fox, and Rogers (2002). They discovered that children with phonological disorders had trouble discriminating consonant-vowel-consonant (CVC) minimal pairs that differed in the final consonant (i.e. “cap” vs “cat”, and “tack” vs. “tap”). The purpose of their study was to examine children’s ability to recognize familiar words when redundancy in the speech signal was reduced, as in a gating task. During the experimental tasks, the children were asked to identify a CVC unit when a portion of the necessary acoustic information was gated, or removed. They discovered that younger children had a more difficult time discriminating CVC words than older children who were typically developing. The authors explained that younger children paid less attention to fine phonetic details due to immaturities in their phonological system. Their results indicated that younger children needed more acoustic information to identify the final consonant in similar sounding words and that those with phonological disorders were less successful than their same aged peers at this task. Another important finding was that younger children and children with phonological disorders seemed to rely on the combination of visual and auditory cues more so than the older and typically developing children.

Together, these articles provide strong evidence that children from various backgrounds or learning conditions experience the phonological characteristics of speech differently. Adding to the explanations already offered is the effects of exposure. Nittrouer (1996) noted that children with histories of low SES backgrounds spoke with their parents less than the children from higher SES backgrounds. This observation suggests a reason why children from low-SES backgrounds may have diminished lexical knowledge. Exposure is very important during early stages of language development (Hart & Risley, 1995; Honig, 1982; Laosa, 1982; Schachter, 1979; Walker, Greenwood, Hart, & Carta, 1994). If children have a lack of lexical exposure due to conditions such as low SES, differences in acquisition may result. Another factor that may add to the acquisition differences in these homes is language variation. It is possible that a more varied form of SAE (i.e., AAE) was used in these homes.

Evidence that Phonological Representations may be Different in Speakers of AAE

Dialect studies have shown that there may be differences in the way that phonological knowledge is stored in the brains of those that speak dialects (Baran & Seymour, 1976; Seymour & Ralabate, 1985). “When working memory contains phonologically confusing information, the semantic and syntactic processes involved in grammatical role assignment become more difficult” (Gray & McCutchen, 2006, p. 326). With the addition of dialect characteristics that alter certain portions of words, it is possible to conclude that assigning semantic and syntactic roles may be difficult. This is especially true for children who are first learning the language.

To specifically target AAE, it is necessary to understand how the dialect changes the phonology of certain words that are being prepared for storage into the lexicon. For example, consider the phonological process of devoicing final consonants. This is a phonological rule of AAE that produces a change in the SAE rule of voicing (Green, 2002; Pollock et al., 1998; Rickford, 1999). Rickford (1999) states that devoicing of word-final voiced stops after a vowel is a distinctive phonological (pronunciation) feature of AAE. This is characterized by the realization of [b] as [p], [d] as [t], and [g] as [k]. It is of interest to note how this dialectal rule influences the retrieval and perception of certain words. For example, in AAE the word “had” can sound like “hat” due to this phonological change. This can present a problem because the new word that is formed is also a frequently occurring word in English. Both the lexical and phonological representations are at risk for ambiguity because changing the word phonologically produces another word that is used frequently in English. Therefore, questions can be raised such as; how is the word *had* stored in the child’s lexicon? Does the potential ambiguity in the words *had* and *hat* influence speech processing in the speakers of dialect?

A problem that could occur during the retrieval of phonological representations is a slowed processing time while the brain is trying to decipher what actually to retrieve to make sense of the context. In fact, one study revealed perceptual difficulties which resulted in a delay of perceptual processing. Floccia, Goslin, Girard, and Konopczynski (2006) discussed perceptual issues in regards to foreign and regional accents in a French community. Over the course of several experiments, the researchers collected data on the perception of five regional accents. The authors suggested “that a regional accent can lead to modifications of the phonological representations used for analyzing the incoming speech signal” (p. 1278). Accent processing is divided into two phases: an initial period (where comprehension is disrupted) and an adaptation period (where comprehension is recovered fully or partially).

Speakers in a French community were asked to listen to sentences in other regional dialects and make perceptual judgments about certain words in the sentences (i.e., "Ann has never seen any *sheep*."). The italicized word indicates where a perceptual judgment was to be made. During the first experiment, the outcomes suggested that in unfamiliar regional dialects, there is a 30ms processing time delay in word recognition during continuous speech for unfamiliar listeners. The second experiment attempted to show if the processing time delay from the first experiment was evident in isolated words also. No significant difference was noted. The purpose of experiment three was to determine if the length of the utterance affected the comprehension of the accent. They determined that as utterance length increased, comprehension difficulties increased also. Therefore, the processing delay while the listener adapted to the accent could be related to inefficient retrieval of phonological information because of dialect unfamiliarity. As the listener was further exposed to the accent, eventually they reached the adaptation period where full comprehension was established. While the article does not dismiss the fact that part of the delay is due to the nature of the accent (such as prosody, pitch, inflections, etc), they definitely found evidence of a lexical access delay as listeners adapted to unfamiliar accents.

Evidence from dialect studies. Seymour and Seymour (1981) attributed differences between young children who use SAE and those who speak AAE to "different emerging phonologies" as opposed to "delayed acquisitional patterns" (p. 274). They argued that African American children's articulation differences reflected developmental aspects of a Black adult system just as White children's articulation differences reflect an emerging White adult system. Specifically, they found that both Black and White children produced the same types of errors on an articulation test. They came to three conclusions: 1) there were a greater number of overall errors produced by

African American children compared to White children, 2) error distributions between place and manner features were different across dialects, and 3) less inconsistency was found in distinctive features among substitution phonemes. These findings suggested that the dialects are distinct and emerge in similar, but unique, ways.

Another study showed similar evidence for a unique emergence of phonology across dialects. Seymour and Ralabate (1985) performed a perception/production study in order to evaluate the phonological feature of substituting /θ/ with /f/, which is a common substitution in both AAE and developmental SAE. Their main goal was to evaluate the difference in both perception and production in words that reflected this substitution. Results indicated that both sets of children (speakers of AAE and speakers of SAE) performed similarly on the production and perception of single words. Both groups were able to hear the /θ/ as the "correct" sound. During conversational speech, however, the AAE speakers used the substitution persistently. These researchers concluded that, "…Productive mastery of the dialect form may be dependent on mastery of discrimination and recognition skills" (p. 147). The authors also mentioned that as children get older, they are better able to code switch between dialects, which may be the reason they were able to perceive the sound correctly yet included the substitution in conversational speech.

Yet another study determined possibilities for a unique emergence. This study suggested that a reason for the difference in emerging phonologies could be due to different phonemic cues available for speakers of different dialects. Baran and Seymour (1976) studied the influence of dialectal phonological rules on the discrimination of minimal word pairs. They suggested that there were certain phonological rules in AAE, such as final consonant devoicing, that could result in two words sounding homophonous. The purpose of their study was to examine children's discrimination of homophonous words without contextual clues. During their experiment, different listener/talker combinations were tested: Black/self, Black/Black, White/Black, and Black/White. Under these conditions, children listened to words and were asked to point to the picture that represented which word they heard. The choices of pictures represented the homophonous word pairs (i.e., if the acoustic stimuli was the word "pig", pictures representing "pig" and "pick" would be available as choices). Based on response patterns, the speakers of dialect perceived the African American talkers differently than the non-African American talkers. The Black children perceived the Black talkers better than White children. Black children also perceived White children better than White children perceived Black children. The authors indicated that there were phonemic cues available for the dialect speakers that were not available for the non-dialect speakers. Although this article did not address the possible cues, it is possible that they were cues indicative of voicing, such as vowel duration and stop-gap closure duration. While non-dialect speakers also used these cues, it is possible that the dialect speakers used different weighting strategies to make judgments regarding the acoustic information.

Evidence from literacy tasks. Research has shown that dialect in fact impacts phonological activities, such as spelling (Treiman & Barry, 2000). Treiman, Goswami, Tincoff, and Leevers (1997) showed the effect of dialect on spelling samples of American and British dialect speakers. In this study, children were asked to spell words that contained a rhotic "r". This dialect feature is the most prominent in distinguishing these two dialects from each one another. The spellings produced reflected which dialect the child spoke based on inclusion or exclusion of the pronunciation of the rhotic “r” in their dialect. For example, in the British dialect, the word “hurt” was more commonly misspelled as “hut” since the “r” is not as salient in British English. The American children more commonly misspelled “hurt” as “hrt” since the “r” is clearly pronounced in American English. Spellings of the control words were consistent between both groups of dialect speakers. Hence, dialectal phonetic features were activated when a standard production of a word was presented.

Another recent study showed the effects of dialect on literacy skills. In this case, Kohler, Bahr, Silliman, Bryant, Apel, and Wilkinson (in press) showed the effects of dialect density on nonword spelling scores. Nonwords were chosen for this project in order to eliminate lexical effects. A total of 80 African American children were divided into two grade groups (1^{st} and 3^{rd} grade) and subsequently two dialect groups (low AAE users and high AAE users). Based on nine different characteristics of AAE, nonwords were developed to assess spelling skills (i.e., “pen” became “len”). The Kohler, Apel, Bahr, and Silliman Spelling Assessment (KABS) was used for scoring the nonword spelling. Spellings were scored based on errors that could be attributed to AAE. Results suggested that high users of AAE in 3^{rd} grade presented with more dialectal patterns in their nonword spellings than low users of AAE in 3^{rd} grade. For the 1^{st} graders, errors represented a number of phonological errors, not only errors attributable to AAE. These findings indicate that dialect affects literacy skills including nonword spelling.

Another study by Sligh and Conners (2003) evaluated the possibility of dialect effects on the performance of a phonological processing task. The inclusion of dialect in one’s language could lead to relative strengths and weaknesses in phonological processing depending on the features and knowledge of the dialect. This is true because it is possible that children who speak a dialect may be more in tune to changes that occur from the standard to their dialect. The opposite could also be true. Children could be less aware of the SAE features because of the inclusion of dialect where they are less likely to use the SAE features regularly. Both initial and final consonant deletion tasks were used by Sligh and Conners (2003) to show these effects. Four different types of tasks were administered to 7-11 year-olds: 1. word initial/outside ("say *prain* without the *p*"), 2. word initial/inside ("say *prain* without the *r"*), 3. word final/outside ("say *hisp* without the p"), and 4. word final/inside ("say *hisp* without the *s*"). The authors hypothesized that use of AAE dialect would have a greater impact on the word-final clusters because that is where most of the phonological changes occur between AAE and SAE. They also hypothesized that outside deletions would be easier than inside deletions for the same reason that there are more phonological changes on that position in AAE. Results supported their hypotheses. Outside deletions were significantly easier than inside deletions for the AAE speakers. Speakers of SAE also performed better on the word-final deletion tasks than on word-initial deletion tasks, where AAE performed worse on word-final deletion tasks than word-initial deletion tasks. This was possibly due to the fact that the speakers of AAE were analyzing word final consonant clusters that are reduced in their own dialect making the analysis more difficult. However, it should be noted that the AAE speakers performed better overall on these tasks than the speakers of SAE and the authors attributed this ability to the AAE speaker's knowledge of two dialects. Hence, this study supported the idea that speakers of AAE may have relative strengths and weaknesses in phonological processing due to the phonological characteristics of their dialect.

In another study of AAE dialect and phonological awareness, Thomas-Tate, Washington, and Edwards (2004) used two standardized tests to analyze the performance of AAE speaking children. The assessments used were the *Test of Phonological Awareness* (*TOPA*; Torgesen & Bryant, 1994), and the *Comprehensive Test of Phonological Processing* (*CTOPP*; Wagner, Torgesen, & Rashotte, 1999). These two standardized tests measure different aspects of phonological awareness. The TOPA focuses on initial and final sound comparisons, while the CTOPP assesses a more general phonological knowledge. The results of the study indicated that the children who spoke AAE performed more poorly on the TOPA, which measured initial and final sound comparisons. Since the children performed better on the CTOPP, which is a more generalized assessment, it demonstrated that their general phonological knowledge may be compensating for their weakened knowledge of finer phonetic details. These results are not surprising considering the rules of AAE. Many of the rules in AAE change aspects of the final consonant resulting in the possibility of a weakened knowledge of that position of words. In summary, these children's general knowledge of phonological awareness may compensate for more specifically defined skills, such as phonemic awareness, making it seem like there is no deficit, when in actuality, the weakness is at a more basic hierarchal level (i.e. phonetic level).

Evidence of a Phonological Processing Deficit

Evidence shows the link between reading and phonological processing very clearly. Literature reveals, through categorical perception studies, that phonological awareness is strongly tied to reading (Bertucci, Hook, Haynes, Macaruso, & Bickley, 2003; Blomert et al., 2004; Breier et al., 2004). Somewhere in the developmental processes, the children mentioned in the following studies have missed out on the essential skills that would enable them to detect fine phonetic changes in speech signals which results in phonological processing deficits.

Breier, Fletcher, Denton, and Gray (2004), during a categorical perception task, tested phonological awareness in children at risk for reading disability. Their results indicated that there was a relationship between reading disability and the categorical perception of phonemes. They found that children at risk for reading disability were less sensitive to phonological changes occurring in the presented speech stimuli (as determined by response to voice onset time [VOT] parameters). Those who had better sensitivity to the VOT changes also had better phonological processing of the speech stimuli. The authors suggested that because of this deficit, children at risk for reading may have a more difficult time interpreting the underlying information in the speech signal. Their results indicated that difficulties while perceiving speech could in turn contribute to difficulties with reading fluency.

Similarly, Blomert, Mitterer, & Paffen (2004) found that children with dyslexia exhibited immature phonological processing abilities when compared to typically developing children. Those with reading difficulties had to rely more heavily on phonetic context in coarticulation rather than acoustic cues available from the individual segment because the individual segment cues alone were not enough information to make judgments about the speech signal. Deficits were noted in the following tasks: a phoneme-deletion task, an auditory word-discrimination task, and a word-recognition task. During the phonological portion of the experiment, no significant differences were noted between the two study groups. However, in experiment two, a significant context effect was found. Context influenced the responses of the children with dyslexia more than the children with normal reading skills. This finding suggests that children with dyslexia may weigh contextual cues more heavily than phonemic cues in individual segments. While this is not necessarily in itself bad, it possibly prohibits children from developing a strong phonetic base. A strong phonetic base is necessary for the development of higher-level literacy skills (Munson et. al., 2005).

In concert with the idea of a processing deficit, Bertucci, Hook, Haynes, Macaruso, and Bickley (2003) found that children with reading disabilities exhibited processing difficulties that were manifested as weak phonological coding. Their experiment evaluated the perception and production of vowels in the following CVC words: /pIt/, /pæt/, and /pɛt/ in children with and without reading difficulties. It was hypothesized that children with reading difficulties would have a harder time distinguishing vowels that were phonologically similar. Differences were found between the subject groups both in the production and perception of the vowels. The children with reading difficulties showed less well-defined categories in both perception and production when compared to normal readers. Based on their perception, they had shallower perceptual slopes, and based on the production of vowel formants, they had more phonemic overlapping. In conclusion, the children with reading difficulty had different perceptual and production patterns.

Similarly, Godfrey, Syrdal-Lasky, Millay, and Knox (1981) hypothesized that children with dyslexia may exhibit deficits in perceptual tasks. They wanted to show how important perceptual accuracy was in the process of learning to read. They stated that learning to read requires the conversion of letters into phonetic equivalents. “This, in turn, requires the availability of some long-term representation of the phonetic units, independent of contextual variations, which must have been formed by abstraction in the process of perceiving speech” (p. 403). When children are learning to read, if they are unable to convert a strand of letters to a perceptual equivalent that is stored in their brain, their ability to process what they read will be diminished. Identification and discrimination tasks were administered in order to show perceptual performance of dyslexic readers vs. normally developing readers. In all of their perception tests, the dyslexic children differed from the normal children in performance, which provides evidence for an immature or different representation storage. It is possible that these children with reading difficulties had trouble discriminating between fine phonetic details in the speech signal. Therefore, they also probably have yet to establish long-term phonetic equivalents to aid in perception. This same relationship between perceptual differences and reading ability is interesting to consider with the dialect population. Little to no research has been done in the area of dialect, which is why research is warranted.

Conclusion

In conclusion, phonological processing impacts reading abilities. Likewise, deficits in phonological processing have potential to impact reading abilities negatively. Several studies have been conducted that support the literature showing that perception, phonological processing, and reading are all connected (Bertucci, et al. 2003; Breier, et al., 2004; Blomert, et al., 2004; de-Gelder & Vroomen, 1998; McBride-Chang, 1996). Evidence has revealed that children with reading difficulties have significant perceptual difficulties (Breier, et al., 2004). Research also demonstrates that children with reading difficulties pay less attention to the phonetic characteristics and rely more on context to make judgments regarding speech signals (Blomert, et al., 2004).

Summary of the Problem

Differences in the storage of phonological representations have the potential to create a problem for speakers of dialect in regards to spoken word processing. This is especially true for children who are first learning the phonological properties of their native language. When they begin to store information as representations into their brain, what effects do features of their dialect have on the development of phonological representations? As mentioned earlier, there are three different hypotheses that explain the effects of a difference in developmental acquisition of phonological representations. They are the: 1) *segmentation hypothesis* (Brady, 1997; Fowler, 1991), 2) *lexical restructuring deficit hypothesis* (Metsala & Brown, 1998; Metsala & Walley, 1998), and 3) the *distinctness hypothesis* (Elbro, 1996; Elbro, Borstrom, & Petersen, 1998). Not enough research has been done in this area to find the exact role that dialect plays, however; it appears to play a role in the development of phonological representations.

Dialect Does Play a Role

It is crucial for children to develop fundamental phonological awareness skills so that they are less likely to suffer from academic failure in the future. Since dialect influences higher-level activities such as spelling (Kohler et al., in press; Treiman, & Barry, 2000; Treiman et al., 1997), it has the potential to influence other, more basic skills, such as perception and discrimination.

Nittrouer and Burton (2005) recognized that impoverishing early experiences can impact the development of phonological skills. They described that for some reason (i.e., OME & SES) certain children did not have access to all the information they needed for a strong phonological base to develop. The current study considered dialect as one of the possible early experiences that could impact phonological skills. By examining studies, such as the ones mentioned in this paper, it is evident that dialect influences phoneme acquisition, as well as the storage of phonological information (Baran & Seymour, 1979; Seymour & Seymour, 1981). Evidence exists to demonstrate that there are differences in phonological processing between speakers of AAE and speakers of SAE (Seymour & Ralabate, 1985; Seymour & Seymour, 1981; Sligh & Conners, 2003). Evidence also revealed that dialect influences activities, such as spelling and reading (Report of the National Reading Panel, NICHD, 2000; Kohler et al., in press; Treiman & Barry, 2000; Treiman et al., 1997). Evidence from nonword spelling tasks (e.g., Kohler et al., in press) provides excellent justification for this study because it taps into phonological representations in ways that other phonological processing tests cannot.

As mentioned before, dialect does play a role in the development of reading. Its exact role is still unknown. However, in another line of research, strong links were made between reading skill and categorical perception (Godfrey et al., 1981). Therefore, a link may be drawn between dialect, perception, and reading abilities. Since phonological representations may be different in the dialect population (Silliman et al., 2002), it is necessary to examine this population at a phonetic level to rule out lexical and contextual effects. In other words, how will this population respond to speech stimuli when they have to rely more heavily on acoustic/auditory information to make their judgments?

It is important to consider all the possible issues that may play a role in determining the effects of dialect on literacy skills. All of the issues that must be considered in determining the role of dialect in perception are illustrated in Table 1.

Table 1. Presenting issues when examining the role of dialect in perception.

Issue	**Reason to consider**
Academic skills	There is a Black-White achievement gap that continues to widen.
Phonological representations	Altered or ambiguous storage of representations is possible with AAE.
Early experiences	Since experiences like OME and SES influence perception, AAE also could serve as an influential early experience.
Phoneme acquisition	Dialect studies show differences in phonemic acquisition.
Spelling	Dialect influences error patterns in spelling.
Processing deficits	Children with reading deficits have perceptual immaturities also.
Perceptual level of Phonological Awareness	Phonological awareness has different levels with perceptual knowledge as basic.
Weighting strategies	Speakers of AAE may weight acoustic cues differently than standard dialect speakers.
Exposure to language aspects	Lack of exposure could in turn lead to deficits or immaturities in language skill.

Purpose

While evidence thus far has shown adequate information describing AAE dialect, there is not enough information to demonstrate the role that dialect plays in perception. It is important to discover if children who speak AAE are using different weighting strategies to make judgments about auditory information, especially when there are phoneme overlaps in the speech signal due to phonological characteristics of their dialect. The purpose of this study was to determine what effects cues indicative of voicing, such as vowel duration and closure duration, may have on the perception of minimal pairs in speakers of a dialect where final consonant devoicing is a prevalent feature. Three questions were specifically addressed.

1. Does the use of final consonant devoicing (as in African American English) in production influence the perception of the voiced-voiceless distinction in VC nonsense syllables?
2. Does grade level influence the perception of the voiced-voiceless distinction in VC nonsense syllables?
3. Does the dialect of the speaker influence the perception of the voiced-voiceless distinction in VC nonsense syllables?

Chapter 2

Method

Participants

Twenty-six monolingual children between the ages of 5-8 years participated in this study. The children were in Kindergarten through grade 2 and were recruited from a local elementary school in west central Florida. The project was approved by the Institutional Review Board (IRB) at the University of South Florida (USF) and the local school district. Classroom teachers assisted the experimenter by sending home parental consent forms. The parents had at least one week to respond. Child assent was obtained at the initiation of the experiment.

The children had to meet the following inclusion criteria: a) speak AAE and be African American or speak SAE, b) pass a hearing screening, c) pass a speech and language screening, and d) have parental/guardian consent to participate in the study. The total number of children tested was 30, but four had to be excluded for different reasons. One child was unable to do the task, two students were classified as ESL (English as a Second Language) students, and one was currently enrolled in the school's speech/language program. The remaining children were eight who spoke AAE and 18 who spoke SAE. In the following table, SAE is represented as Mainstreamed American English (MAE) because the DELV uses that term. Summary statistics for the participants are listed in Table 2.

Table 2. Summary statistics of participants.

Participant	Age (yrs., mos.)	Race	Grade	Dialect	Gender
AA1	7,7	African American	2	MAE	F
AA2	7,11	African American	2	MAE	F
W3	7,6	White	2	MAE	F
AA4	8,1	African American	2	AAE	M
H5	8,8	Hispanic	2	MAE	F
H6	7,11	Hispanic	2	MAE	F
M8	7,8	Other	2	MAE	M
M9	7,8	Other	2	AAE	F
W11	6,2	White	K	MAE	F
W12	7,1	White	1	MAE	M
AA13	7,3	African American	1	AAE	F
W14	7,0	White	1	MAE	M
AA15	5,01	African American	K	MAE	M
AA16	6,2	African American	K	AAE	M
W17	6,4	White	K	MAE	M
H18	5,8	Hispanic	K	MAE	F
M21	7,3	Other	1	MAE	F
W22	5,8	White	K	MAE	F
AA23	6,1	African American	K	AAE	F
W24	5,4	White	K	MAE	M
H25	5,9	Hispanic	K	MAE	F
H26	6,4	Hispanic	K	MAE	F
H27	5,7	Hispanic	K	MAE	M
AA28	6,2	African American	1	AAE	M
AA29	7,1	African American	1	AAE	M
AA30	6,0	African American	1	AAE	M

Four women recorded the experimental stimuli. Three of them worked at the local university as professors or clinical supervisors. The other talker was a graduate student in the Communication Sciences and Disorders program at the local university. Two talkers were speakers of SAE and were Caucasian, and two were speakers who could code switch between SAE and AAE and were African American. Consent was obtained in order to record the stimuli. These talkers were used in order to determine if there was a relationship between race of talker and perception.

Materials

Hearing and speech/language screeners. Prior to the experiment, hearing and speech/language screeners were administered to the children to rule out any hearing difficulties or speech/language delays. A calibrated audiometer was used to test the children's hearing in a quiet room. Hearing levels at 20dB were screened at 1000, 2000, and 4000 Hz. The local school protocol was used to assess the children's speech and language development. This protocol measured various aspects of language, as well as articulation. Teacher input also was obtained regarding speech, language, and hearing abilities to informally confirm the results of the screeners.

Language variation measure. The *Diagnostic Evaluation of Language Variation* (*DELV*; Seymour, Roeper, & deVilliers, 2003) was administered to determine if the children were dialect speakers. The DELV has a screening section that measures the child's *Language Variation Status*. The first part requires the child to repeat five sentences to assess phonology. The second part elicits utterances that contain verb tenses that could be affected by language variation. The verb tenses that are assessed on the screener are 3rd person singular (have/has), 3rd person singular (-s,-es), 3rd person singular (do/does), and the copula (was/were). The results specify the degree of language variation as a strong variation for Mainstreamed American English (MAE), some variation from MAE, or strong variation from MAE, which would classify them as speakers of AAE.

Phonological awareness screener. Portions of the *Comprehensive Test of Phonological Processing* (*CTOPP*; Wagner, Torgesen, & Rashotte, 1999) were administered in order to gain information regarding the child's phonological awareness abilities prior to testing. Two versions of the test were used, depending on the ages of the participants. One version is for ages 5 and 6 years, while the other is for ages 7 to 24 years. Both versions measure phonological awareness skills and provide a phonological awareness composite score based on the scores of specific subtests. The three subtests that measure phonological awareness skills are: Elision, Blending Words, and Sound Matching. The Elision subtest assesses the child's ability to say words when asked to say the words without one of the sounds in the word (e.g., "Say tan without the t"), blending words requires the child to say a word when given only the sounds that comprise the word (e.g., "What word do these sounds make h-a-t?"), and sound matching which requires the child to select a word out of three words that starts with the given sound (e.g., "Which word starts with the sound /n/ like 'nest'? Nut, bed, or cake?). The screener for 7-24 year olds only uses the scores from the Elision and Blending Words subtest to formulate a phonological awareness composite. Standard scores for each subtest were obtained and added together to obtain the phonological awareness composite standard score.

Stimuli

Stimuli selection. All plosives were paired with vowels that occurred at different points on the vowel quadrilateral and resulted in the most instances of VC nonsense syllables. Therefore, the vowels that were selected were: /I/ as in "lift", /a/ as in "hot", /æ/ as in "apple", and /ʌ/ as in "cut". Once all vowels were matched with the six American English plosives, the following nineteen VC units resulted: /Ip, Ib, Id, Ik, Ig, ap, ab, at, ak, ag, æp, æb, æk, æg, ʌb, ʌt, ʌd, ʌk, and ʌg/. Any plosive-vowel combinations that made real words were discarded to avoid lexical effects in the processing of the stimuli.

Stimuli recording. The experimental stimuli were recorded by four different women in a sound proof booth in a speech lab. The talkers were speakers of SAE and speakers who code switch between SAE and AAE. Using a portable Optimus 33-3013 microphone, the nineteen different syllables were recorded on a Sony Vaio laptop computer. The syllables were each written in phonetics and given to the speakers. The talker repeated each syllable in a set of three (eg. /Ip Ip Ip/. All of the final consonants were released. The middle syllable was used for the syllable manipulation from voiced to voiceless consonant.

Praat (Boersma & Weenink, 2001) was used to record and edit the VC syllables. Time measurements for the following two parameters in each syllable were computed in milliseconds: vowel duration and stop-gap closure duration. The measurements were obtained by the experimenter from a spectral graph of the signal. Measurements of the parameters were extracted from the middle portion of the signal to refrain from altering any existing transitions. These parameters were used because they are strong indicators of consonant voicing and they could be easily manipulated in the syllables that were used (Hillenbrand, Ingrisano, Smith, & Flege, 1984; Krause, 1982; Lisker, 1967; Raphael, 1972).

Stimuli manipulation. It was necessary to change each of the stimuli across the vowel duration and stop-gap closure duration by adding or subtracting milliseconds from each individual stimulus to turn a voiced phone into its voiceless cognate. Since the vowel duration prior to a voiced consonant is longer than the vowel duration prior to a voiceless consonant, milliseconds were cut from the vowel duration of the voiced syllable to incrementally shorten the length of the vowel duration to achieve perception of a voiceless consonant (Borden, Harris, & Raphael, 2003). Likewise, since the stop-gap closure duration is shorter prior to voiced consonants, milliseconds were added to the stop-gap closure duration to make it sound like a voiceless consonant. Segments were extracted from the center portion of the signal so that transitions were not included. Full pitch periods were extracted in order to achieve natural sounding stimuli. The stimuli were altered from voiced to voiceless because it was easier to produce a better sounding stimuli going in that direction.

Since the vowel durations and stop-gap closure durations were different across the various stimulus items and speakers, it was necessary to normalize the changes that were to be made to each syllable during the experimental manipulation so that the stimuli were changed in a similar fashion regardless of VC composition. In order to do this, the changes made to each syllable (from all talkers) were computed as percentages of 25% change, 50% change, 75% change, and 100% change. At 100% change, the VC stimulus was the cognate of its original phone (i.e. /b/ became /p/). To get these percentages, the difference between vowel durations for each pair of cognates was divided by four. Likewise, the difference between the stop-gap closure durations for each pair of cognates was divided by four. Milliseconds were cut or added to the voiced consonant to achieve values for vowel duration and stop-gap closure duration representative of a voiceless consonant. The two parameters were changed together for each syllable as opposed to individually because it was determined that by only changing one parameter, not a big enough difference in voicing was achieved in the speech signal.

Testing stimuli selection. The final manipulated stimuli yielded 160 individual VC syllables (10 voiced phonemes in VC syllables x 4 speakers x 4 percentage change intervals). Depending on the experiment, these syllables were arranged in combinations of either pairs (same/different task), or categories of 5 (each percentage change represented) VC syllables (continuum task). The stimuli for the same/different task were paired to themselves and across all levels of change. The stimuli for the continuum task were arranged in a 5-point continuum from voiced to voiceless or vice versa in sequential order. The stimuli for each task were randomly selected. Those stimuli that were not selected for testing tasks were used for the training tasks. Therefore, stimuli used in the training tasks were not part of the testing tasks.

Experimental Tasks

Paired comparison task. The acoustically manipulated stimuli were placed into EcoS/Win (AVAAZ Innovations Inc., 2002) experiment generator, which can generate different perceptual tasks. The first task was a paired comparison task where the participant was asked to click "same" or "different" to note if they heard a difference between the two-presented stimuli. During this task, a "happy" and "sad" face picture appeared on the computer screen so that young children could easily recognize the meaning of their response choices. A "happy" face corresponded to stimuli that were the same, while a "sad" face corresponded to stimuli that were different.

Prior to the experiment, the children had a training session where they could familiarize themselves with the task. The training session consisted of 20 stimuli. The first couple of stimuli were conducted without the headphones over the computer speakers with the help of the examiner. Reinforcements were provided to the participants during the training session. The participants were encouraged to ask questions if they did not understand. Once the children demonstrated they were able to perform the task, (i.e., by demonstrating an understanding of the task as judged by the examiner) the examiner presented the test stimuli. During the actual testing, 130-paired stimuli were administered. The children had the option to repeat the stimulus if needed.

Continuum task. The second type of task was a continuum task. For this task, there were five numbered boxes on the computer screen, each representing a sound along the continuum from voiced to voiceless or vice versa. When the participants heard a change or shift in the sound from the voiced to the voiceless phoneme, they were instructed to press the box that corresponded to the sound where they heard the shift. On the screen, boxes with the numbers 1, 2, 3, 4, and 5 were displayed. The stimuli were presented in a sequential order starting from the either the voiced or voiceless cognate and moving in order from 25% up to 100% or from 100% down to 25% manipulation, where the last stimuli was the cognate of the first stimuli presented. The 100% change was a manipulated signal. An announcement (i.e., "number 1") was made prior to each stimuli presentation to avoid any response confusion. The child also had the choice to repeat the stimulus item one time if desired.

The children were trained prior to this experimental task also. Eight continuum sets were used to train the children. When the children demonstrated they were able to perform the task, (i.e. demonstrating an understanding of the task as judged by the examiner), the test stimuli were presented. Twenty-four continuum sets were administered during testing.

Procedures

The testing was conducted over two separate sessions. On the first day of testing, the children were brought from their classroom into a quiet, individual room on the school's property. Consent was solicited upon arrival. The participants completed the hearing screening, speech/language screening, language variation screener, and phonological awareness screener. For some of the children, the language variation screener was administered on the second day of testing due to time constraints. The order of the screening tests was randomized across participants in order to account for fatigue. The first session lasted approximately 30-45 minutes. Once the children were finished, they received a reward for their work.

The second day of testing occurred within two weeks of the previous session. The children were again picked up from their classroom by the experimenter. They were brought into the same testing room and instructed to sit down at the laptop computer. A Sony Vaio laptop was used to administer the experimental tasks. The children were instructed as to the nature of the task prior to its administration and given a set of headphones to wear. The headphones were cleaned after each child with anti-bacterial wipes.

A trial run using the ECoS/Win experiment generator was administered first in order to train the subjects to the experimental task. Once the researcher felt that the participant was acquainted with the equipment, real test stimuli were presented. Task order was randomized across participants to avoid an order effect. A short break was given in between the two experiment types to give the children a small break. The second session lasted approximately 30-45 minutes. Once the children were finished, they received a reward from the experimenter.

Data Reduction

In order to prepare for statistical analysis, the experimental data were extracted from ECoS/Win and placed into Excel spreadsheets for further analysis. To illustrate listener ability to identify voiced/voiceless distinctions during the same/different task, listener responses were analyzed using the d' measure of signal detection theory (Macmillan & Creel, 1991). This measure provides a numeric equivalent (d') representing the ability of the child to respond appropriately when taking into account listener response bias. The listener response bias is taken into account by considering the listener's hit rate and false alarm rate. The hit rate represents the percentage of time the listener responded correctly to the relationship between the CV pair (same or different). The false alarm rate represents the percentage of times when the listener responded that the stimuli were "same" when they were actually "different". The percentages from these measures are converted to a normal distribution z-score. The d' measure is the difference between Z (Hit rate) and Z (False Alarm rate). A d' of 1 or greater signifies that the listener was able to perform the task greater than chance.

To illustrate listener ability to identify phonetic changes on a continuum, listener response patterns were analyzed using frequency counts. For the continuum task, frequency counts were computed for each child's responses. The number of times a child chose each category on the continuum task was recorded. The ratings of the speakers were adjusted so that the ratings accurately reflected the voiced/voiceless change. In other words, when the continuum went from voiceless to voiced, the values were reversed—a 2 rating became a 4 and a 1 rating became a 5 and vice versa. This way, the ratings consistently reflected the point of change from voiced to voice phoneme. Once these ratings were obtained, they were summed across grade and dialect to prepare for statistical analyses.

Statistical Analyses

Same/different task. The d' from the signal detection theory analysis was computed. These values were analyzed in two separate Kruskal Wallis Analysis of Variances (ANOVAs), one considering differences in dialect group and the other considered differences in grade.

Continuum task. A chi-square analysis was used to show differences in performance across the continuum. The frequency counts computed were analyzed to show differences in response patterns across dialect groups and grades.

A three way Multivariate Analysis of Variance (MANOVA) was run to show differences in mean listener ratings across speakers. Post hoc tests were used to show differences across speaker and consonants.

Correlation statistics were run to find relationships significant to phonological awareness abilities. The CTOPP scores were analyzed across grade and dialect with the d's and frequency counts to determine possible relationships.

Chapter 3

Results

This study was designed to determine if use of AAE, a dialect that features final consonant devoicing, influences the perception of final consonants in VC nonsense syllables. Twenty-six typically developing children in grades K-2 participated. Four women (2 African American and 2 Caucasian) provided the speech stimuli, which consisted of nonsense productions of vowel + plosive consonants. These stimuli were then systematically altered by changing the vowel and stop-gap closure durations simultaneously, resulting in the final consonant changing from a voiced consonant, like "ib", to a voiceless consonant, like "ip". Two tasks were utilized: a same-different task which involved determining if two stimuli were identical in voicing or not and a continuum task where the child had to indicate when the stimuli changed in voicing. The research questions focused on noted differences in perception by dialect use, grade, and speaker race.

Same-Different Task Results

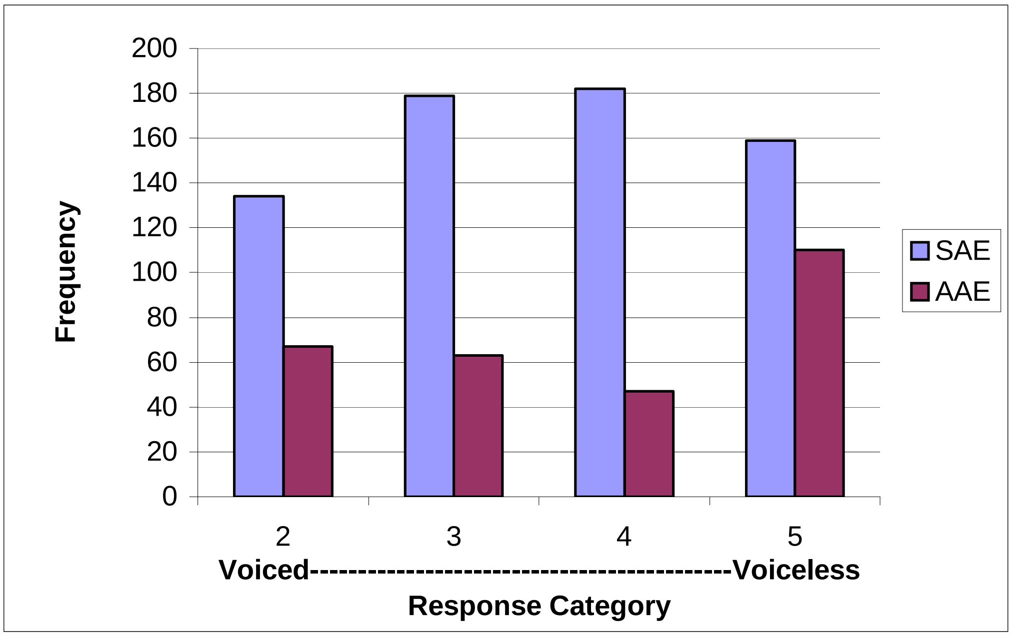
To analyze the effects of dialect use and grade, differences in mean d' across conditions were analyzed using two separate Kruskal-Wallis ANOVAs. The d' served as the dependent variable and dialect and grade as the independent variables. No significant differences between groups were found for dialect use, $\chi^2(1) = .020$, $p = .889$ or for grade, $\chi^2(2) = 1.223$, $p = .542$. It is possible that there were no significant differences because of the small number of participants used or because of the difficulty of the task. Further analysis revealed that 19/26 participants were able to perform the task with a d' of 1.0 or more. With scores above 1.0, it can be assumed that the children were able to perform the task at levels greater than chance. Therefore, the present findings indicated that most of the participants were able to perform the task, but that the same/different task was indeed quite difficult. Statistics were run again with the children taken out who could not perform the task, and the results were still insignificant. This further supports the idea that neither dialect use nor grade influenced the perception of voicing in this task.

Continuum Task Results

Data from this task were analyzed using chi-square analyses to show differences in subject response patterns across dialect status and grade. In order to extract the needed information for this analysis, frequency counts of the individual responses were obtained for each child. Responses for each unit in the continuum task were then summed across participants by dialect status and grade. It was expected that responses would cluster synergistically around units 3 and 4. Actual responses showed more variability than expected.

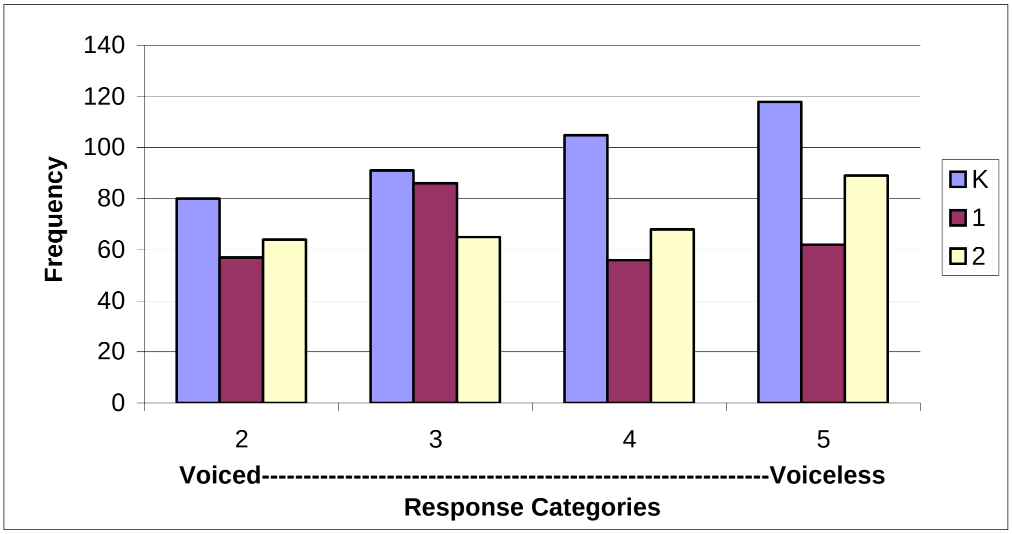
Response patterns attributable to dialect. The chi-square analysis for differences in response patterns attributable to dialect was significant, χ^2 (3) = 24.35, p <.01. As illustrated in Figure 1, the speakers of AAE (n= 8) chose the last point on the continuum most frequently, while SAE speakers (n=18) selected points 3 and 4 more often, with 5 response occurring frequently. These findings would suggest that the use of final consonant devoicing may be a factor influencing the patterns of performances here. Since the stimuli were manipulated from voiced to voiceless and vice versa, the selection of the final point on the continuum would indicate that the distinction between these two types of phonemes must be maximally different for the children to respond.

Figure 1. Distribution of responses to the continuum task by dialect.



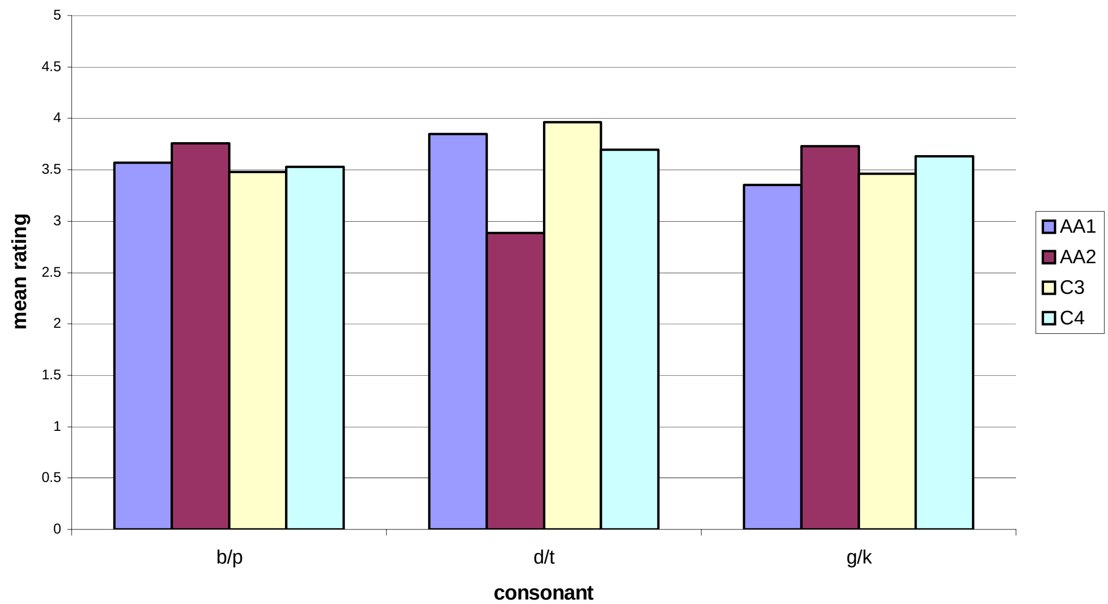
Response patterns attributable to grade. The chi-square analysis for differences in response patterns attributable to grade also was significant, χ^2 (6) = 12.55, p =.05. This finding would suggest that the children responded differently to the continuum stimuli depending on their grade level. As illustrated in Figure 2, students in Kindergarten showed a steady increase in response, with the largest number of responses occurring at the final point in the continuum. This pattern suggests that they may have found the task difficult and did not hear the difference in voicing until the maximum difference was apparent. First graders picked the second point on the continuum most frequently and the second graders maintained a relatively constant response across the continuum, with the last point (#5) receiving the largest number of responses.

Figure 2. Distribution of responses to the continuum task across grades.



Response patterns attributable to speaker. To note differences on listener responses to the continuum task that may be attributable to speaker, a three-way Multivariate Analysis of Variance (MANOVA) was run with consonant as the within subject factor and speaker and dialect as the between-subject factors. The mean rating served as the dependent variable. This analysis revealed a significant consonant by speaker interaction, $F(6,192) = 6.27$, $p < 0.001$, $\eta^2 = .164$. This finding would suggest that the perception of consonants varied by speaker. Post hoc testing with the Tukey A procedure revealed that across speakers, 4/18 paired comparisons were significant; As illustrated in Figure 3, when looking across subjects for each consonant, talker AA2 (African American) was different from all talkers on /t/ and /d/ and talker AA1 was different from subject 2 on /k/and /g/. When considering differences that are within speaker and across consonant, 5/12 paired comparisons were significant. In this case, talker AA1 was different on /t/ and /d/ vs /k/ and /g/. For talkers AA2 & C3 (Caucasian), /t/ and /d/ were different from /p/ and /b/, and /k/ and /g/ (but in different directions). For talker C4, there were no significant differences across consonants.

Figure 3. Distributions of mean speaker ratings by target consonant.



CTOPP Correlations

The nature of the tasks warranted the inclusion of a phonological awareness assessment. It was also important to include this assessment to determine if these results agreed with Thomas-Tate et al., (2004) who determined that speakers of AAE generally do well on phonological awareness assessments. Deficits occur, rather, in more specific tasks of phonological awareness as opposed to deficits in tasks that assess a general knowledge. Correlation statistics were run to find any relationship between performance on the phoneme perception tasks, dialect, and phonological awareness skills. Correlations with the CTOPP scores and the d' from the same/different task were analyzed by dialect and found to be non-significant. Correlations with the CTOPP scores and mean ratings from the continuum task were analyzed by dialect and also were non-significant. This means that these children are achieving general phonological awareness. It is possible though that these children are achieving phonological awareness differently or that deficits occur at basic levels that are somehow compensated for.

Conclusion

In attempts to find correlations between dialect, grade level, and perception, several important results were obtained. First, during the same/different task, no significant differences between groups were found for dialect use or grade. During the continuum task, a chi-square analysis for differences in response patterns attributable to dialect was significant. Likewise, a chi-square analysis for differences in response patterns attributable to grade was also significant. During the continuum task, a significant consonant by speaker interaction was also found. Post hoc analyses revealed that 4/18 paired comparisons across speaker and consonant were significant. Post hoc analyses also revealed that 5/12 paired comparisons within speaker and across consonant were significant. All correlations with the CTOPP were found to be non-significant, suggesting that phonological awareness skill was not a important factor in these more phonetic tasks.

Chapter 4

Discussion

The current study examined the relationship between dialect status and perception of final consonants in 26 children in grades K-2. Two different tasks were administered in order to determine this relationship. Analyses determined no significant differences in the response patterns of the participants during the same/different task. Three important findings were extracted from the continuum task. First, analysis showed significant differences in response patterns related to dialect use. Second, analysis also showed differences in response patterns across grades. Third, significant differences were found in performances across perception of speaker by consonant. Explanation of these results follows.

Same/Different Task

The first task focused on the ability of children to make judgments regarding voicing when presented with two similar sounding stimuli. Results indicated that the mean d' showed no significant differences in performances attributable to dialect use or grade. Closer examination of the d' values revealed that 19/26 children achieved scores of 1.0 or greater. These findings would suggest that while most children were able to perform this task at levels slightly greater than chance, there were some participants that had difficulty. The noted difficulty in performance could be due to the nature of the stimuli. Since less is known about the interaction of stop-gap closure and vowel duration in producing the voiced-voiceless contrast in the final word position than voice onset time (VOT) in the initial word position, it was difficult to manipulate the stimuli consistently across talkers. Percentages of each parameter were used as an attempt to be consistent, but it is possible that talkers uniquely alter these parameters and that changes in final consonant voicing are more representative of a continuous, as opposed to categorical, variable (Raphael, 1972). As a result, the stimuli did not represent an abrupt change in voicing, as in VOT. Therefore, it is possible that the children's difficulty with the task could be partly attributed to the weaknesses of the stimuli.

Continuum Task

Several important findings were noted in the continuum task. The differences in response patterns attributable to both dialect use and grade were significant, as well as differences in mean ratings attributable to speaker and consonant. This task required that the participants choose when the speech signal changed during the presentation of a continuum of changes in parameters associated with final consonant voicing. The participants had four different categories to choose from when deciding when the signal changed. Perceptual differences based on dialect use will be discussed in detail first.

Influence of dialect on perception. As shown in the chi-square analyses, differences in response patterns existed for children who spoke different dialects. These results are consistent with previous research. Baran & Seymour (1976) determined that children who speak AAE may experience homophony while making judgments regarding speech signals. Seymour & Seymour (1981) came to similar conclusions regarding differences in AAE developmental speech patterns. While there were differences in the number and type of errors, the differences noted in both dialects were developmental in nature. It could be that the children in this experiment were experiencing a difference in their processing of speech information. It is possible that these children had different phonological representations that were retrieved during the process of perception. This could be explained by the possibility of different emerging phonologies.

Speakers of AAE may have to rely on different cues in order to make judgments regarding speech because of the characteristics of their dialect. Consider the following example. Suppose a first grade teacher writes the word “hand” on the board. She then asks the students to identify the /d/ sound. The children in the class who are speakers of SAE do not have much difficulty with this task. The children who speak AAE may have to process this word differently than SAE speakers. In their dialect, the word “hand” becomes “han” because of final cluster reduction (Green, 2002). Hence, they may have difficulty perceiving the /d/ sound in a final cluster if it is absent in their own production. It is possible they use other cues to determine the presence of the sound. This project does not necessarily reveal what the different cues are, but the current results suggest that children who use AAE might have different phonological representations of the word making perception different.

Ambiguity in phonological representations could in turn lead to difficulties in lexical development (Brady, 1997; Elbro, 1996; Elbro, Borstrom, & Petersen, 1998; Fowler, 1991; Metsala & Brown, 1998; Metsala & Walley, 1998). Language aspects, such as reading, rely on the retrieval of stored phonological representations. If these phonological representations are not stored efficiently because of ambiguities, children will have difficulty retrieving these representations when needed in order to make lexical judgments. This creates a critical problem for children who are at the pre-school age. As children who speak AAE are learning their language initially, it is possible that they are storing phonological representations differently. Then once they reach school, they may have difficulty in language tasks, such as reading and spelling, because of the differences in phonological representations.

In this study, there were differences between the response patterns of those who spoke AAE and those who spoke SAE. Participants who spoke AAE chose number 5 on the continuum most frequently where speakers of SAE chose 3 and 4 more frequently. This finding would suggest that dialect did influence the perception of final consonant voicing. The children who spoke AAE needed the maximum degree of change between stimuli in order to perceive a difference in voicing. Speakers of SAE were able to detect the shift a little earlier. These findings in no way suggest that dialect impedes the perception of voicing, instead they indicate that the speakers of AAE may be relying on different cues to detect a change in voicing and the manipulations conducted in this experiment hindered voicing perception. This interpretation is more consistent with Nittrouer and her colleagues who found that children used different cues than adults when perceiving consonants (Nittrouer, 1996; Nittrouer & Crowther, 1998). Further research should be conducted on how speakers of AAE use voicing cues in the perception of final consonants. This knowledge could be important in understanding the phonological representations of children who speak both AAE and SAE and how this knowledge impacts vocabulary development (Storkel & Morrisette, 2002).

These finding are also in concert with Sligh and Conners (2003). Their research showed that depending on the characteristics of the spoken dialect, speakers may have relative strengths and weaknesses in regards to phonological awareness abilities. For example, they may be better processors of phonological information that is present frequently in their dialect, but the may be weaker at processing phonological information that is not as frequent in their dialect. In this case, it is possible that use of final consonant devoicing (as in AAE) lead to differences in their ability to perceive voicing in final consonants. Therefore, it is possible that children who speak AAE have a less mature ability to hear differences between two speech signals that differ in final voicing or experience ambiguity in accessing their phonological representations because in their dialect, these phonemes are (at times) homophonous (Baran & Seymour, 1976).

In order for children to discriminate between sounds, they must have clear phonetic boundaries in their phonological representations. If therefore, these boundaries are not fully established, homophonous words may impede future vocabulary learning. It could be argued that children rarely have to rely on phonetic aspects for speech perception, however, the development of new vocabulary requires this skill (Storkel & Morrisette, 2002). Further research is warranted to show what the noted perceptual differences actually mean, but it is evident that the differences are present.

Influence of grade on perception. In the chi-square analysis, response patterns across grade were determined to be significantly different. Review of the frequency table revealed that the three grade levels performed differently from one another during the perception task. Kindergartners appeared to choose the last step in the continuum most frequently suggesting that they did not hear fine phonetic differences until the greatest amount of phonetic difference was available. This is in concert with their schooling and age. Children in kindergarten have a basic understanding of letters and sounds. As they continue to develop their language skills, children's perceptual maturity also develops. It must also be noted, as stated in the previous section, speakers of AAE choice number 5 on the continuum most frequently. This could suggest that the speakers of AAE have a perceptual maturity more similar to the younger children.

First graders picked the second point on the continuum most frequently. This level of the continuum represents minimal changes to the speech signal. These findings suggest the first grade children may be more in tune to the phonetic changes in speech because of the emphasis on word decoding and other aspects of phonological awareness as they learn to read. They are gaining more exposure to different cues present in speech. The exposure to those cues may have made it easier for them to make judgments regarding the speech stimuli.

Patterns in second grade responses showed that they responded across the continuum rather consistently. Their most common choice was number 5 on the continuum, which like the kindergartners, suggests they had difficulty hearing differences in the speech signals until the maximum amount of change was available. This finding may also be a consequence of their stage of schooling. Once children reach second grade their development of language and reading also advances. These children are moving into more lexical-based learning—a greater focus on whole words, as opposed to focusing on phonemes. Hence, these findings do not suggest a perceptual deficit, rather a shift in perceptual knowledge and a reliance on different cues for perception.

This information agrees with the literature regarding developmental changes in phonological knowledge. Munson et al. (2005) suggested four different types of knowledge essential for phonological processing. The first stage begins at the phonetic level and then gradually shifts to a higher-level knowledge as a person’s understanding of their native language matures. The higher-level knowledge allows a person to use multiple advanced cues to make judgments. This concept is apparent in the responses across grades. The younger children used their basic level of phonological knowledge to make judgments. Therefore, their responses showed the least mature ability to perceive acoustic differences. As the children progressed to first grade, their responses indicated a more developed perceptual knowledge at the phonemic level. Then as the children reached second grade, they performed more like the kindergarteners. This may suggest that those children were looking for higher-level cues, such as lexical cues that were not available. It is also possible that the older children were lexically processing the carrier phrase (i.e. the number stated before the stimulus), which impeded their phonetic processing of the nonsense syllable unit. Finally, the older children could have been distracted by the nonsense stimuli because they were anticipating a longer lexical unit.

Influence of speaker and consonant on perception. During the continuum task, a significant consonant by speaker interaction was found. In other words, the participants responded differently to consonants based on which talker was speaking. This suggests that children are able to adjust to different speaking models effectively. Children receive different talker models as they develop language. Their production models differ when they are at home (i.e. parents, siblings), school (i.e. teachers, educators), or in different environments (i.e. church, doctor's office). If dialect is heavily included in their home environment, it is possible that the language model they receive in school could be significantly different. While they receive variable speech signals, they must be able to adapt in order to make judgments regarding phonetic details. This is in concurrence with Munson et al. (2005) and Rvachew's (2006) hypotheses that state children receive different phonemic models and are still capable of perceiving speech appropriately. Since there was much variability in the productions of the nonsense syllables, the children had to adjust to the differences in models.

For this project, when looking across and within subjects for each consonant, the listeners responded significantly different depending on the consonant. After analyzing the syllable information, it was evident that there were no phonetic differences attributable to ethnicity; Post hoc testing revealed that talker AA2 was different from all talkers on /t/ & /d/, talker AA1 was different from AA2 on /k/ & /g/. Within talkers, talker AA1 was different on /k/ & /g/ vs. /t/ & /d/. For talkers AA2 & C3, /t/ & /d/ were different from /k/ & /g/ and /p/ & /b/. Talker C4 showed no differences across consonants. These differences in response patterns across speaker and consonant show the variability in speech productions that all children must learn to appropriately process.Strengths of the Current Study

There were several strengths of this pilot study that must be discussed. When considering what type of stimuli would be most appropriate, it was determined that nonsense stimuli would show the most effective results for a couple of reasons. Use of real word stimuli would allow the listener to rely on lexical cues and not phonetic cues alone. The stimuli for this project accounted for that problem. By creating nonsense syllables, lexical effects were controlled thereby creating a purely phonetic task.

Another strength of this study was the inclusion of two tasks during the procedures. The significance of having two testing measures for this project was crucial for different reasons. Multiple tasks allowed the children to demonstrate their knowledge in different manners. In addition, during statistical analysis, one of the tasks did not show significant differences. If only the same/different task was used, no significant differences in performance would have been found. It appeared that the children had difficulty with the same/different task. Therefore, it was beneficial that the continuum task was also administered. In this instance, it was a more sensitive task.

Yet another strength of this current project was the inclusion of the CTOPP phonological awareness composite scores. Due to the nature of the project tasks, a phonological awareness screener (CTOPP) was administered to identify any children that might have difficulties with overall phonological awareness. Results of the CTOPP screener showed that all of the children performed within ± 1 sd of the mean regardless of dialect or grade. The fact that no significant differences between groups on this task were found concurs with the present literature regarding emerging phonologies in speakers of AAE (Seymour & Seymour, 1981; Thomas-Tate, Washington, & Edwards, 2004). Seymour and Seymour (1981) suggested that the developing phonology is intact for speakers of AAE. It does appear to be different, not lacking. Thomas-Tate et al. (2004) suggested a similar hypothesis. In their study, based on the outcomes of the CTOPP, overall phonological processing skill between dialect groups was similar. The results from this study concur with existing literature regarding overall phonological skills in speakers of AAE.

Weaknesses of the Current Study

When discussing the results of this project, it is important to note the disadvantages. Firstly, it is important to note the small sample size (n=8) for the AAE speaking group. Ten children were African American and four were mixed ethnicities (African American & Caucasian). In the subject group that volunteered, only a small group actually tested on the DELV as speakers of dialect. It is possible that more children tested were dialect speakers, but they were able to code switch and did so during the process of being tested. Another contributing factor could be the location of the school. The school involved was in a middle class neighborhood, with government funding housing close to the school. Results may show greater differences in a population with a lower socioeconomic status and heavier influence of dialect in their environment.

Stimulus Generation and Manipulation

Voicing parameters. Difficulties with the stimuli must also be noted. During the generation and manipulation of the stimuli, a few problems were encountered. The first issue involved the parameters that were chosen for manipulation. Since final voicing was the issue here, vowel duration and stop-gap closure duration instead of VOT needed to be manipulated. This was more difficult than expected. It was decided to alter these parameters simultaneously because changing only one parameter did not create detectable differences to the examiner. This decision may have resulted in unnatural manipulations of the desired parameters, in that it was assumed that each parameter could be manipulated equally (as demonstrated by the percentage changes used) and simultaneously. The latter idea makes the performance of the SAE group even more interesting because they were able to adjust to this form of manipulation and the AAE speakers experienced more difficulty.

Another decision that was made concerning the stimuli was which direction to present and change the stimuli during the tasks. Since the stimuli were being put into a categorical perception task, they needed to be changed from voiced to voiceless and vice versa. Bi-directional changes (voiced to voiceless & voiceless to voiced) were made at first. It was determined by the examiner that when the changes were made from voiceless to voiced, adding milliseconds to a sound resulted in an unnatural production. When milliseconds of speech were extracted from the signal, more realistic sounding stimuli were produced. Therefore, the stimuli only reflect a change from voiced to voiceless.

It was also evident that the two parameters did not interact systematically meaning that a change in one parameter did not necessarily affect the other parameter in the same manner. Therefore, changes made to the stimuli were not systematic. Instead of manipulating each sample individually by milliseconds, the stimuli were manipulated by percentages. In other words changes made to the stimuli differed for each individual stimulus. Therefore the changes made to the stimuli were not linear meaning that a change to one stimulus did not equate to the same change on another stimulus.

Talker variability. Another reason that the stimuli were difficult to manipulate was the fact that the talkers showed significant variability in their productions of the nonsense syllables. Speakers did not show any production patterns that would allow for linear changes to the stimuli. In fact, their productions were extremely variable in regards to vowel durations and stop-gap closure durations. The lengths of the parameters varied both within and between subjects. Therefore, since the vowel durations and stop-gap closure durations significantly differed in length across speakers, the changes had to be made based on percentages. For example, in the nonsense syllable /æg/, Talker 3's vowel duration was 455 milliseconds, compared to Talker 4's vowel duration of 183 milliseconds for the same syllable. Their relative closure durations were 92 milliseconds verses 52 milliseconds. Since the millisecond durations differed between the parameters substantially, it was difficult to make equivalent changes by an actual millisecond length. Hence, the stimuli had to be changed individually by percentages (i.e., 25% change relative to the vowel duration or stop-gap closure duration). Therefore the changes made to the stimuli were not linear. It is also possible that the shift in voicing actually occurred in the middle of an item on the continuum making the perception of change occur later in the continuum than it actually did.

Future Studies

Future plans for this type of study are numerous. Since differences in the perception of phonetic details have been found, there is a need for research to continue investigating the reason for these differences. It is possible that studies using different characteristics of AAE would be beneficial (i.e., omissions, & substitutions). AAE has several rules that change the phonology of the dialect (i.e. replacing interdental fricatives with labiodental fricatives, consonant cluster movement, postvocalic consonant reduction, monophthongization of diphthongs, etc.; Craig & Washington, 2006; Green, 2002; Pollock, et al., 1998). Investigating any of these characteristics may achieve differences in perception as well. More investigations must be conducted that focus on the phonetic level of perception where context can be excluded to be able to describe the influence of dialect on the development of phonological representations.

Another type of study that may be beneficial is an evoked response potential (ERP) study. ERP studies could detect differences in perception across dialect by investigating how the brain responds to phonetic changes in speech signals. By looking at brain waves, it would be possible to see when the differences occur, and what part of the speech signal receives the greatest response differences.

Reading studies are also a way that this type of research could be headed. Research shows that reading deficits are often linked with perceptual difficulties, (Bertucci et al. 2003; Breier et al., 2004; Blomert et al., 2004). Likewise, development of reading and higher level skills requires the proper storage and retrieval of phonological representations (Munson & Babel, 2005). Including reading scores could help make a stronger link between perception, phonological representation, and reading development. Since there is a large portion of children who have reading difficulties, including those children in these studies would be helpful. Including reading scores in future studies may help better pinpoint certain deficits.

Conclusion

In conclusion, it is evident that children who speak AAE present with differences in their perception of final consonants in VC nonsense syllables. AAE speakers' response patterns suggest they may have perceived voicing later on a continuum task than the speakers of SAE. This is suggestive that the dialect speakers may have been using different cues to make judgments regarding the speech signal, or that the speakers of AAE have a less mature ability to extract fine phonetic detail due to the influence of certain characteristics of their dialect (Baran & Seymour, 1979). It also suggests that they may have different emerging phonologies that may influence the storage of phonological knowledge (Seymour, & Seymour, 1981; Thomas-Tate et al., 2004).

These results are important for several reasons. Although the literature says that these children perform fairly well on phonological processing tasks (Thomas-Tate et al., 2004), however other studies show that dialect may be influencing other linguistic tasks, such as spelling (Kohler et al., in press; Treiman, & Barry 2000; Treiman, et al., 1997).

Therefore, dialect does play a role. The exact nature of the role is still undetermined. The results from this pilot study have important implications for future research. It is hard to identify what these differences mean; however, with more research in this area, important conclusions may be drawn.

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APPENDICES

Appendix A: Vowel duration and closure duration measurements

The following key explains what the values are:

A. Beginning vowel: where the duration of the vowel began for the specified CV unit
B. Ending vowel: where the duration of the vowel ended
C. Difference: the difference between **A** and **B**
D. Total ms: the total difference in milliseconds
E. Beginning CD: where the closure duration began
F. Ending CD: where the closure duration ended
G. Differences: the differences between **E** and **F**
H. Total ms: the total difference in milliseconds
I. VD difference: the difference between the two vowel durations divided by 4
J. CD difference: the difference between the two closure durations divided by 4
K. 0%: values representing 0% change to both vowel duration and closure durations
L. 25%: values representing 25% change to both vowel duration and closure durations
M. 50%: values representing 50% change to both vowel duration and closure duration
N. 75%: values representing 75% change to both vowel duration and closure duration

P. 100%: values representing 100% change to both vowel duration and closure duration

Talker 1

	ud		ut
A. Beg Vowel	0.204001	**A**. beg vowel	0.235091
B. End vowel	0.4479	**B**. end vowel	0.365298
C. difference	0.243899	**C**. difference	0.130208
D. total ms	244	**D**. total ms	130
E. beg CD	0.461084	**E**. bed CD	0.393754
F. end CD	0.569379	**F**. end CD	0.567077
G. difference	0.108295	**G**. difference	0.173323
H. total ms	108	**H**. total ms	173

I. VD difference=114/4=28.5ms
J. CD difference=65/4=16.25ms

	K. 0%	L. 25%	M. 50%	N. 75%	P.100%
	224ms	215.5ms	187ms	158.5ms	130ms
	108ms	124.25ms	140.5ms	156.75ms	173ms

Talker 1

	ug		uk
Beg Vowel	0.201352	beg vowel	0.246024
End vowel	0.446565	end vowel	0.369249
difference	0.245213	difference	0.123226
total ms	245	total ms	123
beg CD	0.45545	bed CD	0.405287
end CD	0.555845	end CD	0.569201
difference	0.100395	difference	0.163914
total ms	100	total ms	164

VD difference=122/4=30.5ms
CD difference=64/4=16ms

	0%	25%	50%	75%	100%
	245ms	214.5ms	184ms	153.5ms	123ms
	100ms	116ms	132ms	148ms	164ms

Talker 1

	ib		ip
Beg Vowel	0.128645	beg vowel	0.224203
End vowel	0.324406	end vowel	0.360518
difference	0.195761	difference	0.136315
total ms	196	total ms	136
beg CD	0.34343	bed CD	0.388286
end CD	0.471688	end CD	0.559943
difference	0.128257	difference	0.171656
total ms	128	total ms	172

VD difference=60/4=15ms
CD difference=44/4=11ms

	0%	25%	50%	75%	100%
	196ms	181ms	166ms	151ms	136ms
	128ms	139ms	150ms	161ms	172ms

Talker 1

	ig		ik
Beg Vowel	0.141534	beg vowel	0.125615
End vowel	0.385043	end vowel	0.218614
difference	0.243509	difference	0.092998

total ms	244		total ms	93
beg CD	0.404217		bed CD	0.245772
end CD	0.495293		end CD	0.40461
difference	0.091076		difference	0.158838
total ms	91		total ms	159

VD difference=151/4=37.75ms
CD difference=68/4=17ms

	0%	25%	50%	75%	100%
244ms	206.25ms	168.5ms	130.75ms	93ms	
91ms	108ms	125ms	142ms	159ms	

Talker 1

	ahb			ahp
Beg Vowel	0.139978		beg vowel	0.159293
End vowel	0.469936		end vowel	0.301164
difference	0.329958		difference	0.14187
total ms	330		total ms	142
beg CD	0.4795		bed CD	0.326498
end CD	0.571155		end CD	0.504681
difference	0.091655		difference	0.178183
total ms	92		total ms	178

VD difference=188/4=47ms
CD difference=86/4=21.5ms

	0%	25%	50%	75%	100%
330ms	283ms	236ms	189ms	142ms	
92ms	113.5ms	135ms	156.5ms	178ms	

Talker 1

	ahg			ahk
Beg Vowel	0.256477		beg vowel	0.091675
End vowel	0.559814		end vowel	0.264954
difference	0.303336		difference	0.173279
total ms	303		total ms	173
beg CD	0.575025		bed CD	0.306015
end CD	0.660031		end CD	0.44973
difference	0.085006		difference	0.143715
total ms	85		total ms	144

VD difference=130/4=32.5ms
CD difference=59/4=14.75ms

	0%	25%	50%	75%	100%
303ms	270.5ms	238ms	205.5ms	173ms	
85ms	99.75ms	114.5ms	129.25ms	144ms	

Talker 1

	ab		ap
Beg Vowel	0.14152	beg vowel	0.158013
End vowel	0.4565	end vowel	0.301963
difference	0.31498	difference	0.14395
total ms	315	total ms	144
beg CD	0.472991	bed CD	0.333452
end CD	0.574411	end CD	0.515188
difference	0.10142	difference	0.181736
total ms	101	total ms	182

VD difference=171/4=42.75ms
CD difference=81/4=20.25ms

	0%	25%	50%	75%	100%
315ms	272.25ms	229.5ms	186.75ms	144ms	
101ms	121.25ms	141.5ms	161.75ms	182ms	

Talker 1

	ag		ak
Beg Vowel	0.103587	beg vowel	0.10763
End vowel	0.427683	end vowel	0.259979
difference	0.324097	difference	0.15235
total ms	324	total ms	152
beg CD	0.441679	bed CD	0.296543
end CD	0.524912	end CD	0.452375
difference	0.083234	difference	0.155832
total ms	83	total ms	156

VD difference=172/4=43ms
CD difference=73/4=18.25ms

	0%	25%	50%	75%	100%
324ms	281ms	238ms	195ms	152ms	
83ms	101.25ms	119.5ms	137.75ms	156ms	

Talker 2

	ud		ut
Beg Vowel	0.25438	beg vowel	0.319775
End vowel	0.542872	end vowel	0.435623
difference	0.288492	difference	0.115848
total ms	288	total ms	116

beg CD	0.550634	bed CD	0.458793
end CD	0.647661	end CD	0.594652
difference	0.097027	difference	0.135859
total ms	97	total ms	139

VD difference=172ms/4=43ms
CD difference=42ms/4=10.5ms

	0%	25%	50%	75%	100%
228ms	245ms	202ms	159ms	116ms	
97ms	107.7ms	118ms	128.5ms	139ms	

Talker 2

	ug		uk
Beg Vowel	0.345005	beg vowel	0.341146
End vowel	0.569302	end vowel	0.471358
difference	0.224297	difference	0.130212
total ms	224	total ms	130
beg CD	0.598461	bed CD	0.491637
end CD	0.684815	end CD	0.605839
difference	0.086354	difference	0.114202
total ms	86	total ms	114

VD difference=94ms/4=23.5ms
CD difference=28ms/4=7ms

	0%	25%	50%	75%	100%
224ms	200.5ms	177ms	153.5ms	130ms	
86ms	93ms	100ms	107ms	114ms	

Talker 2

	ib		ip
Beg Vowel	0.314669	beg vowel	0.182359
End vowel	0.500915	end vowel	0.295211
difference	0.186246	difference	0.112852
total ms	186	total ms	113
beg CD	0.511813	bed CD	0.305355
end CD	0.626731	end CD	0.44165
difference	0.114918	difference	0.13631
total ms	115	total ms	136

VD difference=73ms/4=18.25ms
CD difference=21ms/4=5.25ms

0%	25%	50%	75%	100%

186ms	167.75ms	149.5ms	131.25ms	113ms	
115ms	120.25ms	125.5ms	130.75ms	136ms	

Talker 2

	ig		ik
Beg Vowel	0.282011	beg vowel	0.307454
End vowel	0.510322	end vowel	0.392682
difference	0.228311	difference	0.085228
total ms	228	total ms	85
beg CD	0.520641	bed CD	0.41073
end CD	0.605774	end CD	0.513004
difference	0.085133	difference	0.102274
total ms	85	total ms	102

VD difference=143ms/4=35.75ms
CD difference=17ms/4=4.25ms

	0%	25%	50%	75%	100%
228ms	192.25ms	156.5ms	120.75ms	85ms	
85ms	89.25ms	93.5ms	97.75ms	102ms	

Talker 2

	ahb		ahp
Beg Vowel	0.223593	beg vowel	0.339081
End vowel	0.52793	end vowel	0.484116
difference	0.304337	difference	0.145036
total ms	304	total ms	145
beg CD	0.535586	bed CD	0.503034
end CD	0.623633	end CD	0.61654
difference	0.088047	difference	0.113506
total ms	88	total ms	114

VD difference=159ms/4=39.75ms
CD difference=26ms/4=6.5ms

	0%	25%	50%	75%	100%
304ms	264.25ms	224.5ms	184.75ms	145ms	
88ms	94.5ms	101ms	107.5ms	114ms	

Talker 2

	ahg		ahk
Beg Vowel	0.348263	beg vowel	0.335198
End vowel	0.599914	end vowel	0.474217
difference	0.25165	difference	0.139018
total ms	252	total ms	139

beg CD	0.654842	bed CD	0.511143
end CD	0.734042	end CD	0.604546
difference	0.0792	difference	0.93403
total ms	79	total ms	93

VD difference=113ms/4=28.25ms
CD difference=14ms/4=3.5ms

	0%	25%	50%	75%	100%
252ms	223.75ms	195.5ms	167.25ms	139ms	
79ms	82.5ms	86ms	89.5ms	93ms	

Talker 2

	ab		ap
Beg Vowel	0.266631	beg vowel	0.338607
End vowel	0.606721	end vowel	0.507012
difference	0.340091	difference	0.168405
total ms	340	total ms	168
beg CD	0.615851	bed CD	0.521321
end CD	0.711716	end CD	0.651203
difference	0.095864	difference	0.129881
total ms	96	total ms	130

VD difference=172ms/4=43ms 172ms/
CD difference=34ms/4=8.5ms

	0%	25%	50%	75%	100%
340ms	297ms	254ms	211ms	168ms	
96ms	104.5ms	113ms	121.5ms	130ms	

Talker 2

	ag		ak
Beg Vowel	0.341048	beg vowel	0.385809
End vowel	0.62094	end vowel	0.568522
difference	0.27989	difference	0.182712
total ms	280	total ms	183
beg CD	0.642767	bed CD	0.599156
end CD	0.731357	end CD	0.687777
difference	0.08859	difference	0.088621
total ms	89	total ms	89

VD difference=97ms/4=24.25ms
CD difference=0ms/4=0ms

	0%	25%	50%	75%	100%
280ms	255.75ms	231.5ms	207.25ms	183ms	

89ms	89ms	89ms	89ms	89ms	

Talker 3

	ud			ut
Beg Vowel	1.055511		beg vowel	2.364414
End vowel	1.255361		end vowel	2.683895
difference	0.19985		difference	0.319481
total ms	200		total ms	319
beg CD	1.260342		bed CD	2.68951
end CD	1.407272		end CD	2.787207
difference	0.14693		difference	0.097697
total ms	147		total ms	98

vowel difference=119ms/4=29.75ms
CD difference=49ms/4=12.25ms

	0%	25%	50%	75%	100%
200ms	229.75ms	259.5ms	289.25ms	319ms	
147ms	134.75ms	122.5ms	110.25ms	98ms	

Talker 3

	ug			uk
Beg Vowel	0.375865		beg vowel	0.417305
End vowel	0.716877		end vowel	0.576818
difference	0.341012		difference	0.159513
total ms	341		total ms	160
beg CD	0.718292		bed CD	0.604669
end CD	0.817341		end CD	0.784438
difference	0.099049		difference	0.179768
total ms	100		total ms	180

VD difference=181ms/=45.25ms
CD difference=80ms/4=20ms

	0%	25%	50%	75%	100%
341ms	295.75ms	250.5ms	205.25ms	160ms	
100ms	120ms	140ms	160ms	180ms	

Talker 3

	ib			ip
Beg Vowel	0.975756		beg vowel	0.028068
End vowel	1.199667		end vowel	0.168343
difference	0.223911		difference	0.140276
total ms	224		total ms	140
beg CD	1.217641		bed CD	0.176291

end CD	1.326002			end CD	0.317362
difference	0.108361			difference	0.14107
total ms	108			total ms	141

vowel difference=84ms/4=21ms
CD difference=33ms/4=8.25ms

	0%	25%	50%	75%	100%
224ms	203ms	182ms	161ms	140ms	
108ms	116.25ms	124.5ms	132.75ms	141ms	

Talker 3

	ig		ik
Beg Vowel	0.34395	beg vowel	0.328025
End vowel	0.592343	end vowel	0.495644
difference	0.248393	difference	0.167619
total ms	248	total ms	168
beg CD	0.594903	bed CD	0.510368
end CD	0.702455	end CD	0.631552
difference	0.107552	difference	0.121184
total ms	108	total ms	121

VD difference=80ms/4=20ms
CD difference=13ms/4=3.25ms

	0%	25%	50%	75%	100%
248ms	228ms	208ms	188ms	168ms	
108ms	111.25ms	114.5ms	117.75ms	121ms	

Talker 3

	ahb		ahp
Beg Vowel	0.339963	beg vowel	0.367821
End vowel	0.719502	end vowel	0.586706
difference	0.37954	difference	0.21885
total ms	380	total ms	219
beg CD	0.724247	bed CD	0.598502
end CD	0.829806	end CD	0.726949
difference	0.105559	difference	0.128447
total ms	106	total ms	128

VD difference=161ms/4=40.25ms
CD difference=22ms=4=5.5ms

	0%	25%	50%	75%	100%
380ms	339.75ms	299.5ms	259.25ms	219ms	

106ms	111.5ms	117ms	122.5ms	128ms	

Talker 3

	ahg		ahk
Beg Vowel	0.058436	beg vowel	0.04361
End vowel	0.362615	end vowel	0.23326
difference	0.304179	difference	0.189651
total ms	304	total ms	190
beg CD	0.394665	bed CD	0.260506
end CD	0.482351	end CD	0.405281
difference	0.087686	difference	0.144775
total ms	88	total ms	145

vowel difference=114ms/4=28.5ms
CD difference=57ms/4=14.25ms

	0%	25%	50%	75%	100%
304ms	275.5ms	247ms	218.5ms	190ms	
88ms	102.25ms	116.5ms	130.75ms	145ms	

Talker 4

	ud		ut
Beg Vowel	0.130525	beg vowel	0.120764
End vowel	0.291632	end vowel	0.226691
difference	0.161107	difference	0.105927
total ms	161	total ms	106
beg CD	0.297698	bed CD	0.246371
end CD	0.368478	end CD	0.321041
difference	0.070779	difference	0.07467
total ms	71	total ms	75

VD difference=55/4=13.75ms
CD difference=4/4=1ms

	0%	25%	50%	75%	100%
161ms	147.25ms	133.5ms	119.75ms	106ms	
71ms	72ms	73ms	74ms	75ms	

Talker 4

	ug		uk
Beg Vowel	0.174006	beg vowel	0.168975
End vowel	0.304053	end vowel	0.274496
difference	0.130047	difference	0.105521
total ms	130	total ms	106
beg CD	0.309103	bed CD	0.292689

end CD	0.368445			end CD	0.358186	
difference	0.059342			difference	0.065496	
total ms	54			total ms	65	

VD difference=24/4=6ms
CD difference=11/4=2.75ms

	0%	25%	50%	75%	100%
130ms	124ms	118ms	112ms	106ms	
54ms	56.75ms	59.5ms	62.25ms	65ms	

Talker 4

	ib		ip
Beg Vowel	0.116005	beg vowel	0.173576
End vowel	0.288275	end vowel	0.297004
difference	0.172269	difference	0.123429
total ms	172	total ms	123
beg CD	0.293584	bed CD	0.305821
end CD	0.36143	end CD	0.409727
difference	0.067846	difference	0.103907
total ms	69	total ms	104

VD difference=49/4=12.25ms
CD difference=35/4=8.75ms

	0%	25%	50%	75%	100%
172ms	159.75ms	147.5ms	135.25ms	123ms	
69ms	77.75ms	86.5ms	95.25ms	104ms	

Talker 4

	ig		ik
Beg Vowel	0.131211	beg vowel	0.130459
End vowel	0.267728	end vowel	0.248742
difference	0.136517	difference	0.118283
total ms	137	total ms	118
beg CD	0.287554	bed CD	0.258545
end CD	0.33627	end CD	0.385323
difference	0.048716	difference	0.126779
total ms	49	total ms	127

VD difference=19/4=4.75ms
CD difference=78/4=19.5ms

	0%	25%	50%	75%	100%
137ms	132.25ms	127.5ms	122.75ms	118ms	
49ms	68.5ms	88ms	107.5ms	127ms	

Talker 4

	ahb		ahp
Beg Vowel	0.140102	beg vowel	0.157893
End vowel	0.344593	end vowel	0.324204
difference	0.204491	difference	0.166309
total ms	204	total ms	166
beg CD	0.356705	bed CD	0.334745
end CD	0.432944	end CD	0.416728
difference	0.076239	difference	0.081983
total ms	76	total ms	82

VD difference=38/4=9.5ms
CD difference=6/4-1.5ms

0%	25%	50%	75%	100%
204ms	194.5ms	185ms	175.5ms	166ms
76ms	77.5ms	79ms	80.5ms	82ms

Talker 4

	ahg		ahk
Beg Vowel	0.099181	beg vowel	0.168676
End vowel	0.276578	end vowel	0.30627
difference	0.177397	difference	0.137594
total ms	177	total ms	138
beg CD	0.300621	bed CD	0.326024
end CD	0.374049	end CD	0.396865
difference	0.073428	difference	0.070841
total ms	73	total ms	71

VD difference=39/4=9.75ms
CD difference=2/4=.5ms

0%	25%	50%	75%	100%
177ms	167.25ms	157.5ms	147.75ms	138ms
73ms	72.5ms	72ms	71.5ms	71ms