I give permission for public access to my thesis and for any copying to be done at the discretion of the archives librarian and/or the College librarian.

Elizabeth L. Tighe

May, 2010

Original to Originality:

Morphological Accuracy and Rates of Word Recognition in Low Literate Adults

by

Elizabeth L. Tighe

A Thesis

Presented to the Faculty of Mount Holyoke College

in partial fulfillment of the requirements

for the degree of Bachelor of Arts

with Honor

Department of Psychology and Education

Mount Holyoke College

South Hadley, Massachusetts

ACKNOWLEDGMENTS

I would like to extend my sincere gratitude to the many individuals that made my senior project a success. I could not have brought this undertaking to fruition without the support, guidance, and encouragement from all of you! First, I would like to thank my advisor, Kathy Binder, for challenging me to excel and pushing me to continue running what seemed like a never-ending number of analyses. Your passion and dedication to the study of adult literacy is evident in our many conversations. You not only inspired me on the current project but also positively impacted my decisions about post-graduate research endeavors. Thank you for all your diligent efforts in reading my drafts, assisting with my statistical analyses, being a prompt responder to my numerous emails, and being available for my unexpected office visits. It was a pleasure working with you!

In addition, I wish to thank the faculty in the Psychology and Education Department – in particular my committee members, Fran Deutsch and Sandy Lawrence. Thank you for your insightful, constructive criticisms and feedback on my drafts. I would also like to extend thanks to Joe Cohen and the members of the 411/412 class for listening repeatedly to my practice presentations and for all your support in meeting appropriate deadlines.

Thank you to Janet Crosby, the organizational guru, for keeping me well informed about funding inquiries, borrowing equipment, and ensuring that everything ran smoothly. I would like to acknowledge the Dean’s Office at MHC for providing the funding for my research through the Ellen P. Reese Fund and the Thomas W. Reese Fund. Additionally, I would like to extend a special thank you to the Harap family for their generous research funding.

To Kellie Payne and the teachers at MCDI: thank you for being so accommodating and allowing me to utilize classroom space and include your students in my study. I would also like to thank the adult participants for being so cooperative in enduring 10 tasks and two days of testing! Furthermore, I would like to thank my six wonderful research assistants: Molly Alvin, Tara Bliss, Yue Jiang, Katharine Kaftanksi, Dawnell Powell, and Katie Silvius for all of your efforts with data collection, coding, and of course for the many laughs!

To my outside committee member and coach, Aldo Santiago, thank you for supporting both my academic and athletic pursuits. I truly appreciate your interest in my project and your understanding when tennis/academic conflicts arose. And, of course, thank you for taking the time to read my draft and attend both presentations!

Finally, I would like to thank my friends and family. To my family: thank you for all of your support – both financial and emotional – over the years. Your constant enthusiasm and interest in my endeavors has really shaped my life path. To my friends – Madi Chatz, Natalie Hsiang, and Alyce Regan – thank you for listening to all of my thesis rants, brightening up the “cave” with decorations, and bringing me caffeinated beverages and chocolate to cheer me up. All of your optimism and motivational chalkboard messages really boosted my confidence in order to make this project a reality!

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

Morphological awareness – an understanding of how words can be broken down into smaller units of meaning such as prefixes and suffixes – has emerged as an important contributor to literacy acquisition. The purpose of the current study was to look at the contribution of morphological awareness independent of phonological awareness to the reading comprehension abilities of adults in ABE programs. Accuracy and reaction times were measured on different types of morphologically complex words as compared with control words matched on frequency in an oral reading passage and in a single word recognition task. Results revealed that adults were sensitive to morphological complexity: performing more accurately and faster on control versus morphologically complex word types. Additionally, morphological awareness was found to be a significant unique predictor of reading comprehension. The educational implications for ABE programs are discussed.

Original to Originality:

Morphological Accuracy and Rates of Word Recognition in Low Literate Adults

Printed material is ubiquitous in the United States. Literacy, the ability to read newspapers and mail, to decipher bus schedules and traffic signs, and to complete an employment application or an election ballot, is an invaluable skill. The level of literacy an individual acquires often shapes his/her social status and economic position. Deficient literacy skills and social indicators such as poverty, employment, crime, health, and social status are related (Rousse & Fantuzzo, 2006). In addition, the cost of low literate adults to society is consequential. Poor literacy skills are perpetuated through generations because children of low literate adults are disadvantaged upon school entrance, which eventuates in a higher probability of dropping out (Kirsch, Jungeblut, Jenkins, & Kolstad, 1993).

The 2003 National Assessment of Adult Literacy (NAAL), a report generated by the U.S. Department of Education, was the first assessment of English literacy in the United States since the 1992 National Adult Literacy Survey. Administered to almost 20,000 adults, the NAAL measured a range of fluency tasks and examined the breakdown of literacy skills across gender, ethnicity and race, employment category, income, and level of education attained. Specifically, the NAAL provided pertinent information about the quantity and prevalence of low literate adults in America. The NAAL defines basic literacy skills as the ability to perform everyday reading tasks – reading and understanding a simple document such as a TV guide, a prescription, or a pamphlet. Below basic literacy is defined as the ability to employ only simple and concrete literacy skills – signing a form and reading brief medical directions. These individuals are labeled "functionally illiterate" because they can't perform everyday life activities – using a computer or filling out an employment application (Kutner, Greenberg, Jin, Boyle, Hsu, & Dunleavy, 2007).

The NAAL results indicated that approximately 14% of American adults read below the basic literacy level; an additional 22% read at the basic literacy level. Although a decrease from the estimated 20% below basic literacy recorded in 1992, these statistics continue to be strikingly high (Baer, Kutner, & Sabatini, 2009). Moreover, the NAAL revealed that while adults who were high-school dropouts or had received a GED accounted for 15% of the sample, they represented 55% of those in the lowest level of literacy (Kutner, Greenberg, & Baer, 2005). Adults deemed below basic literacy levels are frequently destined for limited employment opportunities and low income which directly impacts their quality of life. To most effectively curb this problem, we must understand the process by which adults acquire language and develop reading and writing skills.

The majority of current research with literacy has focused on the way in which children process words and acquire literacy skills. Many Adult Basic Education (ABE) programs utilize testing materials, instruction methods, and models of reading developed for children. It is important to note that adults and children differ in many areas related to reading. Adults typically have much more experience with language and more exposure to the printed word. When compared with children, adults process language differently; they utilize higher order cognitive functions to comprehend words, to state opinions, and to understand more complex arguments (Adams, 1990). Thus, it is essential to recognize that these differences may have implications with regard to determining the best approaches to teach reading skills to adults in ABE programs.

For both adults and children, the acquisition of literacy skills is predominantly based on fundamental language skills, including phonological awareness, morphological awareness, and orthography. According to Good, Gruba, and Kaminski (2001), phonological awareness is the ability to distinguish and manipulate the sound structure of language. Phonological units, referred to as phonemes, are individual sound bits that help readers recognize and detect differences in words. Readers employ phonological awareness when attempting to “sound out” and decode unfamiliar words (Carlisle, 2000). Until recently, the preponderance of research on children’s literacy acquisition has focused on phonology; performance on phonological awareness tasks was considered the most important predictor of reading achievement (Carlisle, 2003). English orthography is morphophonemic in nature, which means that written words are characterized by the way they sound (phonemes) as well as by their meanings (morphemes). If the English language was purely based on phonetics, words would be spelled the way in which they sound. For example, the past tense of trap would become *trapt* or pluralizing leg would result in *legz*. Since English spelling encompasses both morphological and phonological components, readers understand that trap, becomes *trapped* and leg would be *legs*. Thus, despite the morphophonemic nature of written English, few studies have considered the interplay between phonological and morphological factors (Deacon & Kirby, 2004).

What is Morphological Awareness?

Originally considered an extension of phonological factors, morphology has emerged as an important contributor to language acquisition. First examined in a classic study by Berko (1958), morphological awareness has been consistently found to play a significant role in reading comprehension, vocabulary expansion, spelling, and word recognition for children and adults (Anglin 1993; Carlisle, 2000; Deacon & Kirby, 2004; Leong, 1999; Nagy, Anderson, Schommer, Scott, & Stallman, 1989). Similar to phonological awareness, morphological awareness aids in the process of learning to comprehend and decode written words. Morphemes are the smallest units of meaning – prefixes, suffixes, and root words (Carlisle, 2003). Readers demonstrate morphological awareness by their ability to understand, recognize, and manipulate morphemes and their structure within words (Deacon & Kirby, 2004). For example, the word *thoughtful* is composed of two morphemes: the root noun, *thought*, which when combined with the suffix, *-ful,* is transformed into an adjective. Furthermore, *thought* represents a free morpheme because the word can stand alone; however,

-*ful* is a bound morpheme because prefixes and suffixes do not have independent lexical status (Carlisle, 2003).

There are three primary types of morphemes: inflectional, derivational, and compounds. These elements are added to root words to produce morphologically complex words. Inflectional morphemes – prefixes and suffixes – alter the tense or pluralize the root word, but keep the word class intact (Carlisle, 2003). The root word *pull* can be put in the past tense with the addition of –*ed* (pulled) or transformed to the present participle by adding –*ing* (pulling); both examples represent the use of inflectional morphology. Adding an –*s* to the end of a root word – *cat* to *cats* – increases the quantity represented by the root word but does not change the meaning of the word. Derivational morphemes usually change the meaning of the root word and can also alter the word class (Carlisle, 2003). The suffix –*less*, meaning "without", can be added to some words – *help* becomes *helpless* – to alter the meaning. Some derivational transformations involve a phonological shift that occurs when the pronunciation of the root word changes – *nation* to *nationality*. An orthographic shift occurs when the spelling of the root word changes but the pronunciation of the root remains intact – *noise* to *noisy.* Finally, some derived words undergo both a phonological and orthographic shift such as transforming the root word *wide* to *width*. Compounds are the linkage of two base morphemes: *high* + *light* becomes *highlight* and *light* + *house* becomes *lighthouse.*

Defined as words containing more than one morpheme, morphologically complex words account for more than 60% of the vocabulary children encounter during reading after fourth grade (Egan & Pring, 2004; Nagy et al., 1989). Anglin (1993) defined a single morpheme word as monomorphemic while subdividing morphologically complex words based on the number of morphemes in the word – words containing two morphemes such as *helpful* are bimorphemic while words with three or more morphemes are multimorphemic such as *incomparable*. Many morphologically complex words are easy to produce, recognize, and decompose into their constituent morphemes because these words follow regular morphological rules. For example the endings -*ing, –er,* and *–est* have only one phonological form, and thus, it is simple to recognize that the inflected word *selling* is composed of two morphemes – *sell* and -*ing.* In contrast, the inflected endings *–s* and *–ed* both have three phonological forms: /-*s*/, /-*z*/, /-*əz*/ and /-*əd*/, /-*d*/, / -*t*/, respectively. Therefore for these types of words, children and adults need developed morphological knowledge to apply the proper endings to root words. Moreover, the English language has numerous irregular word forms which become completely different forms when changing tenses, and therefore, they are not considered morphologically complex. The word *man* becomes *men* when pluralized while *run* changes to *ran* in the past tense. These new forms are no longer considered morphologically complex. Instead, these forms are classified as a single morpheme word or monomorphemic in nature (Anglin, 1993).

Morphological Analysis

An individual's ability to use his or her morphological knowledge, to understand the rules governing root words and affixes, and to determine the meaning of unfamiliar morphologically complex words is defined as utilizing morphological analysis. For example, if a reader encounters a novel derived word such a *volcanology*, he or she can assess the meaning of the word by being aware of the root word, *volcano*, and the suffix *–ology* to produce an educated definition (Larsen & Nippold, 2007). Several studies have noted an increase in the ability to employ morphological analysis in determining word meanings and expanding vocabulary from the early elementary school years through adulthood with the most rapid growth occurring between the fourth and eighth grades (Anglin, 1993; Berko, 1958; Freyd & Baron, 1982; Nagy, Diakidoy, & Anderson, 1993).

Anglin's (1993) study investigated the growth in the vocabularies of first, third, and fifth graders by addressing morphological word types (inflectional, derivational, and compounds) as well as morphological complexity by including monomorphemic, bimorphemic, and multimorphemic words. Anglin wanted to understand the development and utilization of "morphological problem solving" – the ability to decipher the meaning of unfamiliar words by analyzing and decomposing words into constituent morphemes (Anglin, 1993, p. 50). Participants were given a word definition task in which they were prompted to give the meanings of morphologically complex words and to explain how they arrived at their answers. Results indicated that the children identified and understood more words as a factor of increasing age and grade with the older children recognizing significantly more derived as well as bimorphemic and multimorphemic words as compared with first and third graders. In addition, morphological problem solving and processing of words increased from 40% in third grade to 51% with the fifth graders.

Anglin's (1993) study provided an understanding of the developmental trajectory in which children acquire new words and the types of words learned. The vocabularies of children in grades one, three, and five expand from roughly 10,000 to 20,000 to 40,000 words with the words increasing in morphological complexity with age and grade. Approximately a quarter of all words a child knows in the early elementary school years are root words such as *happy.* With increasing development as well as the ability to understand morphological rules and to engage in morphological problem solving, children become better equipped to decipher related words – *unhappy*, *happiest,* and *happiness* (Anglin, 1993). Nagy and Anderson (1984) estimated that for every word learned, there are an additional one to three morphologically related words that children can understand by utilizing morphological analysis. Clark and Berman (1987) reported that as children progress in age, they are capable of expanding their lexical repertoire from monomorphemic words to bimorphemic words, and finally to multimorphemic words. Several studies have also reported that children's knowledge of derivational morphemes is acquired much later than inflectional morphemes and compounds (Berko, 1958; Brown, 1973; Clark, 1982; Wysocki & Jenkins, 1987).

Development of Morphological Awareness and Rules

Children are able to apply inflectional morphology and compounding rules as early as the preschool years (Berko, 1958; Brittain, 1970; Clark & Hecht, 1982). Researchers Clark and Hecht (1982) observed that children as young as three years old could produce fictitious compounds – "fix-man" for a car mechanic or "plant-man" for a gardener – and by five years old children produce correct compounds with greater morphological complexity. Berko's (1958) study investigated the development of children's knowledge of morphological rules by utilizing nonsense words. Nonsense words were included to ensure that all words were unfamiliar to the children, and thus unable to be previously rehearsed and encoded to memory. Nonsense words guarantee that children actually have an internalized understanding of how to apply morphological rules. Children ranging from ages four to seven were shown pictures, given the pronunciation of the nonsense word, and then asked to produce different grammatical forms of the nonwords. For example, Berko administered a picture of an imaginary animal referred to as a *wug.* The child was told, "This is a wug. Now there is another one. There are two of them. These are two ____." Children were expected to pluralize the singular *wug* by adding an *–s* inflection to the end to form *wugs*. Results indicated that the majority of even the youngest children were able to append the necessary *–s*, a clear indication that preschoolers have awareness for basic inflectional morphology.

Berko's (1958) study also included adult participants – all of which were college graduates – in order to provide standard answers in order to rate the children's scores. Adults and children were asked to give a name for a "very tiny wug." Approximately 50% of adults identified a *wuglet,* while others labeled the creature as a *wugling.* Adults were applying their knowledge of real words to the imaginary animal – a little pig is known as a piglet and a young duck is called a duckling. Children on the other hand created two words as if forming compounds – *baby wug* and *little wug*. Similarly, when prompted to provide a word for a house where a *wug* would reside, 58% of adults described a *wughouse,* whereas only 18% of the first grade children named a *wughouse*. These results demonstrated that adults are more likely to form new derived words and base their responses on prior knowledge of the English language while children are more likely to use a compounding pattern rather than applying derivational suffixes.

Although preschoolers have some knowledge of inflectional endings and the ability to recognize compounds as comprised of two free morphemes, they have more difficulty with more complex inflectional endings, such as knowing to apply *–es* rather than just an *–s* or recognizing changes in the past tense of irregular words (Berko, 1958). Studies have reported the tendency for preschoolers and early elementary school-aged children to produce overregulation errors when applying the past tense inflection *–ed* (Marcus, Pinker, Ullman, Hollander, Rosen, & Xu, 1992; Brown, 1973). Creating words such as *runned, comed,* and *goed*, demonstrates that children implicitly understand inflectional morphological rules even though these words are orthographically and phonologically incorrect.

Clark (1982) predicted a more gradual development of derivational morphology throughout childhood and through the high school years. Knowledge of inflectional morphology continues to evolve over the elementary school years. Nunes, Bryant, and Bindman (2006) predicted that because of the three different phonemic representations of the inflectional *–ed* ending, children are not able to master the ability to form the past tense until at least the third grade. Knowledge and awareness of derivational morphology begins as early as preschool but rapidly increases from first to fourth grade and continues to develop until adulthood (Carlisle, 2003). Preschoolers have the ability to understand simple derivational affixes such as adding the *–er* agentive suffix to words including *teacher* and *walker*; however, they have more difficulty applying derivational affixes in words that undergo orthographic and/or phonological shifts (Anglin, 1993). Berko's (1958) study with nonsense words illustrated the tendency for preschoolers and first graders to form compound words whereas adults produced correct derivational affixes. For example, children and adults were asked what a "dog covered with quirks" was called. The adults utilized their knowledge of derivational morphology to form a *quirky dog* while children formed a compound, a *quirkdog*.

Freyd and Baron (1982) found that typically-developing eighth grade students could not fully utilize derivational rules when assessing paired derivational words. Derwing and Baker (1979, 1986) studied college students' and elementary school students' abilities to recognize pairs of derivational morphological relations and discern if one word came from the other. Word pairs were classified into three types: phonetically similar while semantically unrelated, phonetically dissimilar while semantically related, or both phonetically and semantically similar. A phonetically similar, semantically dissimilar pair retained the pronunciation of the root word in the derived form – *bash* and *bashful* – however, the words shared no meaning. Phonetically unrelated, semantically related did not sound the same; however, the words were related in subject matter – *kitten* and *cat*. Finally, phonetically and semantically similar pairs were clearly morphologically related – *teach* and *teacher* – retaining both sound and meaning within the pair. Results indicated increasing derivational awareness with increasing age – the college students tended to rely on both semantic and phonological information to determine morphological relatedness while elementary school children depended on either a high degree of semantic similarity or a high degree of phonological relatedness. Thus, depending solely on phonological skills becomes less important with increasing age and grade; children begin to rely more on applying morphological rules and developing greater morphological awareness. The present study included both inflectional and derived morphologically complex words with low literate adults and distinguished between errors on inflected versus derived words. The study also incorporated derived words varying on degree of orthographic and phonological similarity and dissimilarity – do age and maturation matter or do low literate adults follow the same developmental trajectory as children by producing more mistakes on derived as opposed to inflected words?

The Link Between Morphology, Phonology, and Orthography

Many studies have hypothesized an interactive model to understand the processing of morphologically complex words. This model relies on the interdependence of phonological, orthographic, and morphological knowledge (Carlisle, 2003; Fowler & Liberman, 1995). Carlisle (2003) provided an excellent example capturing the interplay of these linguistic skills during reading when a sixth-grade girl encountered unfamiliar morphologically complex words. The sixth grader was presented with the following sentence: "The harsh winter storms resulted in the migration of the tribe to a new locality" (p. 297). The student was unfamiliar with two word meanings – *locality* and *migration* – however, she was able to utilize her phonological, orthographic, and morphological knowledge to understand the entire sentence. Her phonological and orthographic skills allowed her to sound out the words and to recognize the familiar and similar sounds and spellings of *local* in *locality* and *migrate* in *migration*. Thus, the girl was able to infer the meanings of the two word meanings by applying her linguistic skills and knowledge of the grammar, spelling, and sounds present in the English language.

In addition to reading and decoding unfamiliar words, “multi-level linguistic processing” allows readers to successfully spell novel words (Carlisle, 2003, p. 297). Nunes, Bryant, and Bindman (1997) proposed a five-stage spelling model in which phonological awareness was the greatest predictor of spelling during the first three stages – children relied almost entirely on the “sounding out” of words in order to spell them. Relying solely on phonological skills resulted in words that were spelled phonetically correctly but orthographically incorrectly – *dogs* spelled as *dogz*. As children mature and progress they become more familiar with grammar and morphemes and thus, the later stages of the model incorporated morphological as well as phonological knowledge when spelling unfamiliar and more complex words.

Jarmulowicz, Hay, Taran, and Ethington (2008) constructed a model to assess the relationship between phonological and morphological awareness in the developmental trajectory of reading acquisition. The researchers found that both phonological and morphological awareness are strong predictors of reading ability. Phonological awareness has a greater impact on reading up until third grade whereas morphological awareness begins to increase after third grade and continues through high school. Phonological awareness is hypothesized to lead to the development of morphological awareness; both measures influence reading comprehension and decoding skills in both written and oral language.

Jarmulowicz et al.’s (2008) study addressed the following question: Is morphological awareness merely an extension of phonological awareness or is morphological awareness an independent entity providing unique contributions to language acquisition? Several studies have attempted to study the role of morphology while controlling for phonological and orthographic factors. Deacon and Kirby (2004) found that morphological awareness has a significant role in single word reading, word decoding, reading comprehension, and pseudoword reading in third through fifth graders after controlling for phonological factors as well as verbal and nonverbal intelligence. The researchers concluded that morphological awareness not only contributes independent of phonological factors in many areas of reading, but also plays an increased role beginning in the later elementary school years. Mahony (1994) noted a positive relationship between morphological awareness and reading comprehension by examining adolescents' SAT scores. Leong (1999) identified that morphological processing had a separate role in automatic word recognition skills in a group of learning disabled college students compared with reading level and chronological age controls.

Previous research supports the notion that phonological skills are vital to early decoding skills and to increasing vocabulary during the early elementary school years; however, these skills become decreasingly less important as children progress through school. Phonological awareness and morphological awareness are correlated yet separate literacy skills; phonological skills develop prior to morphological skills (Jarmulowicz et al., 2008). As children become better at utilizing phonological skills, morphological skills become increasingly important as a function of age and grade in reading comprehension, vocabulary growth, decoding, and spelling. Nagy, Berninger, and Abbott (2006) found significant growth in the importance of morphological awareness on different literacy tasks between the fourth and fifth grade levels and the eighth and ninth grade levels. Therefore, it is important to distinguish between phonological and morphological awareness and their independent contributions to reading processing and skills while simultaneously retaining the co-dependent nature of morphology and phonology in early literacy acquisition. The purpose of the current study was to assess the morphological knowledge and awareness of low literate adults in literacy programs by looking at errors in different types of morphologically complex words as well as the rates of word recognition. In addition, the study measured adults' general reading skills and assessed phonological awareness and morphological skills separately. It is important that previous research has determined that morphological awareness is an independent predictor of reading skills across a span of ages after controlling for phonological awareness.

Morphology, Frequency, and Familiarity with Words

In addition to the role of phonology and orthography, several studies have reported that the factors of frequency and familiarity with words and word parts play a significant role in determining a reader's awareness of the morphological structure of words (Carlisle, 2003; Carlisle & Katz, 2006; Egan & Pring, 2004; Reichle & Perfetti, 2003). The more exposure a reader has to printed words, the greater the opportunity to build mental lexical representations to enhance familiarity with words. Researchers Katz and Carlisle (2006) found that the frequency of derived words, root words, and the size of the word family are important in aiding in word recognition. All individual words have frequency values determined by the Standard Frequency Index (SFI), an index containing millions of words with ratings in terms of frequency of occurrence within written texts (Carroll, Davies, & Richman, 1971). For example, "maturity" has an SFI of 35.3, while "security" has an SFI of 49.1 (Carlisle & Katz, 2006). Frequencies were determined based on a logarithmic transformation in which the standard base unit is an SFI of 40 indicating that the word is found once in a million running words of third through ninth graders' texts. The index increases incrementally: an SFI of 50 means that a word is found once in 100,000 words and an SFI of 60 indicates a word is found once in 10,000 words. Generally, an SFI value of 50 or higher denotes a high frequency word while an SFI of 37 or lower indicates a low frequency word. Words with greater SFIs are hypothesized to be more familiar to elementary school children and thus, more rapidly identified and processed than those with lower SFIs (Larsen & Nippold, 2007).

Root words with greater frequencies are also more likely to facilitate word identification as compared to lower frequency base words. If a low frequency word such as "queendom" is encountered, readers will have an easier time recognizing the word because of its high frequency base word, "queen" (Carlisle & Stone, 2005). Family size – the total number of morphologically complex words that contain the same root word – is another important factor in the frequency of words and word recognition. Base words from large families, such as "love", have a greater chance of being encoded because they are contained in more words as compared to base words from smaller families, such as "serene". Recent research has controlled for types of frequency and the number of syllables in words in order to determine the importance of sensitivity to morphological structure in speed and accuracy of word recognition.

Frequency as well as the transparency of words is imperative to analyzing the structure of morphologically complex words and word recognition. Phonological transparency refers to base words that are intact in the derived form of the word: "growth" is phonologically transparent because the root word "grow" retains its pronunciation. "Finality" is not phonologically transparent because the pronunciation of "final" changes. This is known as a phonological shift. Orthographic transparency indicates that the spelling of the root word is maintained in the derived form. While "quickly" represents orthographic transparency, "decision" does not because "decide" is not intact. Both types of transparency affect awareness of morphemic structure. Previous research has found that phonological transparency aids in recognizing the morphemes within words (Carlisle, 2000).

Carlisle and Stone (2005) utilized measures of frequency and transparency in their study examining the role that morphemes play in the speed and accuracy of reading derived words by lower and upper elementary students. In the first part of the study, students were presented with individual words transparent in both spelling and sound. Words contained two morphemes ("hilly") as well as single morpheme, pseudo complex derived words ("silly") and were matched for spelling, word length, and word frequency. The students were also presented with low frequency derived words – all of which contained high frequency base forms ("puzzlement") – to investigate the role of base word familiarity on speed and accuracy in word recognition. Results indicated that both lower and upper elementary students read derived two-morpheme words more accurately and faster as compared to single morpheme words. Moreover, the high frequency base forms in low frequency words played a significant role for upper elementary students but not for lower elementary students.

Larsen and Nippold (2007) utilized the same low frequency with high frequency base words as in the Carlisle and Stone (2005) study. These researchers used a series of prompts in which sixth graders had to provide a definition for these words as opposed to just reading them. For example, a student was asked for the definition of the word *beastly*, how they knew the definition, and if the word was composed of smaller parts. These researchers concluded that middle schoolers were capable of applying morphological analysis to understand low frequency derived words.

The second part of the Carlisle and Stone (2005) study investigated the speed and accuracy in reading derived words which differ in phonological transparency – shift words versus stable words – for middle and high schoolers.

The researchers compiled a list of phonological shift words ("majority") and stable words ("maturity"), which controlled for spelling, word length, base frequency, and derived-word frequency. Also, to avoid the impact of orthographic transparency, the researchers incorporated words that included and excluded orthographic changes. Previous research indicated that words undergoing phonological shifts present difficulties for children learning to read (Carlisle, 2000). Thus, the researchers hypothesized that elementary students would read stable words faster and more accurately as compared to shift words. The results indicated that both groups of students were more accurate on stable as compared to shift words.

Carlisle and Katz (2006) studied the extent to which factors of frequency, including family size and base frequency, influenced the reading of derived words for both skilled and less skilled fourth and sixth graders. The researchers composed lists of words that differed in frequency characteristics but were matched for word length. The first list compared words from large families and small families. Results indicated that fourth and sixth graders performed better on words from large families: sixth graders performed better than fourth graders; and good readers performed better than poor readers. Another list identified high frequency versus low frequency derived word forms; however, all words contained high base frequencies. For example, "friend" and "beast" are both high frequency bases, but "friendly" is a high frequency derived word and "beastly" is a low frequency derived word. Results indicated that less skilled fourth graders had the greatest difficulty with this task. The researchers concluded that their results were consistent with past research: older students and better readers were significantly more accurate and faster at reading derived words because familiarity and higher quality lexical representations increase with reading experience (Reichle & Perfetti, 2003). The present study investigated both inflectional and derived words while altering frequency and transparency measures – including high frequency derived and pseudo complex derived words, low frequency words containing high frequency bases, and shift and stable words in both single word recognition tasks and in an oral reading passage.

Morphological Awareness and Word Recognition

The importance of automatic word recognition skills and the relationship to morphological processing has been a current research focus especially in regard to children and adolescents with learning disabilities. The majority of the research utilized computers for word-naming tasks in order to compare groups in speed and accuracy of recognizing morphologically complex words. Raveh and Schiff (2008) employed visual and auditory morphological priming to investigate morphological awareness in adult Hebrew readers with dyslexia. Morphological priming allows researchers to study the effects of morphological structure on word recognition. Priming provides the participant with morphologically related words in order to elicit the proper identification. Thus, priming relies on repetition and is thought to initiate a transfer effect in which the root morpheme is extracted from the prime to aid in identifying the target word. For example, if the participant is given the prime word, “driver” and the sentence, “Children are too young to _____.”, the answer “drive” would be extracted from the prime. Since dyslexics exhibit below average performance in recognizing written words, spelling, and comprehension skills, the researchers hypothesized that the dyslexics would exhibit deficiencies in visual priming when compared with age and reading level groups. Results confirmed that dyslexics lacked priming when visual stimuli were used, but demonstrated priming effects with auditory stimuli.

Leong (1999) also investigated word-naming tasks by using computer tasks with college students with learning disabilities. She studied morpheme boundaries by exposing readers to proper boundaries (walkED) versus slight changes that disrupt the morpheme boundary (walKED). By comparing rate and accuracy between the learning disabled group and reading age (RA) and chronological age (CA) groups, Leong found that interrupting the morpheme boundary showed reading disruptions for the CA group but not for the RA and learning-disabled groups. Thus, the learning-disabled and comparable RA groups were not affected by disruption to morpheme boundaries, which contributes to their lower levels of morphological awareness. The current study included single word recognition tasks utilizing a computer with inflected and derived words as well as morphologically complex words adhering to and disrupting morpheme boundaries as adapted from Leong (2000) to measure reaction times and accuracy of identifying words.

Morphology and Context

Contextual clues contained in written texts have also been found to promote the processing and understanding of unfamiliar morphologically complex words (Sternberg, 1987). Anglin (1993) reports that context effects begin to play a more important role in word learning and increasing vocabulary after the third grade because children have developed some morphological knowledge and rules and are able to apply morphological analysis to infer the meaning of new words. The average fifth grader reads approximately one million words of text in a year – this translates to 25 minutes of reading per day at a rate of 200 words per minute for 200 days a year (Nagy & Anderson, 1984; Nagy & Herman, 1987). Moreover, of the one million words of text encountered per year, approximately 15,000 to 55,000 different words are novel to the reader (Nagy, Herman, & Anderson, 1985). Thus, the factors of frequency and familiarity of words combined with the contexts in which one encounters these words become increasingly important as a function of age and grade to interpreting and processing morphologically complex words.

Wysocki and Jenkins (1987) tested fourth, sixth, and eighth graders on their abilities to use morphological and contextual information to define unfamiliar words. The researchers were interested in understanding morphological generalization – word structure analysis – in which children draw upon previous knowledge of familiar word roots to infer the meaning of derived word forms of the root. The researchers investigated the use of sentence context by presenting unfamiliar words in strong and weak contexts. A strong context was defined as including clues that would help students infer the meaning of the word, whereas a weak context included little or no indication of word meaning. As an example for the target word *melancholia*, a strong context sentence was: “After Jack’s puppy died, his *melancholia* was so bad that he didn’t want to play with his friends.” A weak context sentence for this same word was: “Her *melancholia* lasted seven days.” Older students (sixth and eighth graders) were better at combining contextual and morphological clues, showing significant improvement of identifying unfamiliar word meanings with the strong versus weak context condition when compared to younger students (fourth graders). The ability of older students to combine information from both sources – morphological rules and context – demonstrates a hypothesis set out by Nagy and Anderson (1984) – that morphological rules and context work together. Older students have more familiarity with words as well as better morphological awareness and thus, they are able to use contextual cues in addition to semantic information to derive word meanings. The current study utilized context by presenting morphologically complex words in an oral reading passage in contrast to the single words presented in isolation on a computer screen.

Morphological Errors

Research designed to study the types of morphological errors is important in understanding morphological awareness and its relationship to reading and writing skills. Many studies have addressed differences in error types made in written versus oral tasks in children. Walker and Hauerwas (2006) noted that children in first through third grades omitted the *–ed* ending far more frequently than the *–ing* ending in their study exploring spelling abilities of inflected verbs. It is hypothesized that the *–ed* ending is harder for children to master because it has three phonetic forms (/-*t*/, /-*d*/, and /-*əd*/) all of which are represented with the morphological ending *–ed*. Thus, children may have greater difficulties differentiating between phonological and morphological representations. The *–ing* ending maintains a consistent sound and thus, children have an easier time recognizing it as a morphological unit.

Smith-Lock (1991) examined inflectional errors in poor versus normal readers in second grade in both their writing and oral tasks. The results indicated that poor readers made more overall errors; however, both groups made more inflectional errors in written tasks and omissions accounted for almost all errors made. Smith-Lock concluded that a lack of morphological awareness contributed to a greater number of errors and that poor understanding of morphological structure led to omissions. Deficiencies in morphological awareness lead children to over-generalize morphological rules such as – "he seted the dolls up" (Carlisle, 1996, p. 70). This example shows a child attempting to apply the regular *–ed* ending to a irregular verb when using the past tense.

Researchers Worthy and Viise (1996) compared adults in literacy classes with children matched on achievement level on mastery of spelling of words with inflectional and derivational morpheme endings. Previous research has noted that low literate adults have difficulties with phonological skills and applying morphological rules (Bailet & Lyon, 1986; Liberman, Rubin, Duques, & Carlisle, 1985; Viise, 1992). Viise (1992) reported that adults made many omissions of inflectional endings – *crack* for *cracking*. Additionally, adults produced words not semantically related to the target word – *success* for *such*. The study compared fourth-grade level adults to fourth graders in an attempt to see if errors for low literate adults followed a predictable developmental sequence. The researchers observed similar error patterns for spelling features – reversing letters – between adults and children. The adults were more successful at spelling root words correctly; however, they made significantly more morpheme ending errors: 81% of morpheme errors involved inflections and approximately half of these errors were omissions. Furthermore, the adults made guesses on unfamiliar words that were not related semantically – *wonder* for *would* and *open* for *other*. These findings suggest that low literate adults may have under-developed phonological skills but more advanced orthographic knowledge in comparison to children matched based on achievement level.

Rubin, Patterson, and Kantor (1991) investigated errors in both inflectional and derivational endings in writing tasks with normal ability second graders, reading disabled second graders, and learning disabled adults. The researchers conjectured that morphemic errors made in writing might translate to spoken task. They also hypothesized that learning disabled children and adults would perform poorly on oral tests of morphological knowledge and make more morphological errors in writing tasks. The learning disabled children committed the greatest number of errors – primarily omissions for both inflectional and derivational endings – as compared with the normal achieving children and learning disabled adults. The fact that adults were comparable to the normally achieving second graders demonstrates that maturation and longer exposure to language had no impact on the adults' morphological knowledge.

Current Study

The present study incorporated two investigations. In Experiment 1, I hoped to assess if adults in ABE programs were sensitive to morphological structure by comparing accuracy on morphologically complex versus morphologically simple words. I further assessed errors on morphologically complex words by categorizing these words into three word types: inflected, derived, and compound words. In Experiment 2, I wanted to examine different aspects of morphologically complexity with low literate adults by measuring accuracy and reaction times on six word types, each matched with control words based on frequency. Accuracy scores were compared on words presented in context versus words presented in isolation. Additionally, a battery of tasks measuring morphological awareness, phonological awareness, and general reading skills was included to determine if morphological and phonological skills predict reading comprehension and to assess if morphological awareness is a unique predictor after controlling for phonological awareness.

INTRODUCTION AND HYPOTHESES – EXPERIMENT 1

The purpose of Experiment 1 was to identify types of morphological errors made by adults in ABE programs by utilizing a pre-constructed passage taken from the DIBELS Oral Reading Fluency (ORF) (Good & Kaminski, 2002). Words in the ORF passage were classified into inflectional, derivational, and compound morphologically complex words; errors were counted. The results provided a sense of common error types made by low literate adults. I hypothesized that the adults would make more errors on morphologically complex words as compared with single morpheme words. I also hypothesized that overall there would be more errors on derivational morphemes as opposed to inflectional morphemes; however, I thought that inflected errors due to omission of endings would also be common. Previous research has found derivational morphology to be more complex for two reasons: shifts in structure and meanings of words; and later development in comparison to inflectional morphology (Carlisle, 2003).

METHOD – EXPERIMENT 1

Participants

The participants included 95 adults attending ABE programs in Western Massachusetts in the fall of 2008. The participants consisted of both males and females, with ages ranging from 16 to 64, with a mean age of 32.88. Participants were from a wide range of ethnic backgrounds: 50.1% Hispanic, 35.3% African American, 7% Caucasian, 1.8% Asian, 1.8% Middle Eastern, and 4.8% Other/Not Specified. The sample consisted of 45.3% native English speakers and 54.7% English for Speakers of Other Languages (ESOLs) students. I furthered classified the ESOL group into non-native literate, characterized by the ability to speak and read in the native language (41.1% of total sample) and non-native illiterate, characterized by only the ability to speak in the native language (13.7% of total sample). Approximately 61% of the participants were unemployed and 38% reported employment. Participants were recruited for the study with the understanding that their information would be kept completely confidential and that they could choose to terminate at any time without consequences. Participants were also compensated for their time.

Materials

Data was obtained by administering the Oral Reading Fluency (ORF) subtest of the DIBELS test. The ORF subtest was designed to measure the ability to read connected text both accurately and fluently (Good & Kaminski, 2002). The ORF short story used for this study contained 226 words and described an elementary school aged girl and her handicapped friend (see Appendix A). The researcher used the written passage, a stopwatch, and a tape and tape recorder to administer the task.

Procedure

The participant was presented with the ORF passage and asked to read aloud for one minute while the researcher concurrently recorded errors in words that had been omitted, substituted, mispronounced, or read out of order as well as hesitations for more than three seconds. Participants were not marked down for self-correcting words within three seconds, adding words, repeating words, or imperfect pronunciation due to dialect, articulation, or second language interference (Good & Kaminski, 2002).

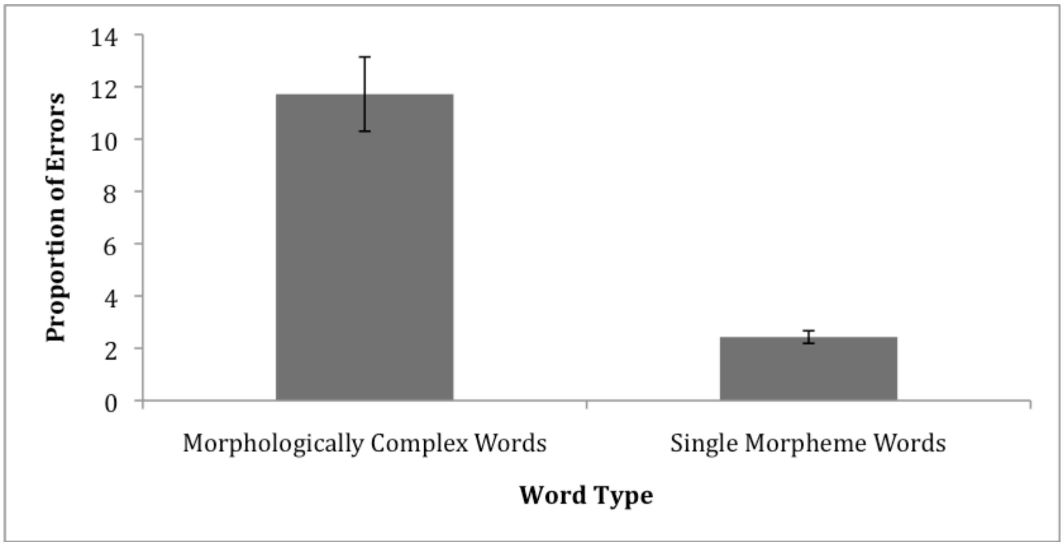
RESULTS – EXPERIMENT 1

Morphologically complex words were identified in the DIBELS Oral Reading Fluency (ORF) passage and classified into inflected, derived, and compound words. I identified a total of 39 morphologically complex words: 19 inflectional, 6 derivational, and 14 compound words. Individual score sheets were evaluated to assess the type and number of morphological errors produced. Finally, error type and number was tabulated as well as an overall count of total number of errors on morphologically complex words as compared with single morpheme words.

I conducted a paired samples t-test to compare errors on morphologically complex words vs. single morpheme words. Since participants were timed for one minute during the ORF passage, each participant had a different total number of words read and read varying amounts of inflected, derived, and compound words. I calculated percent variables to account for differences in word type totals. I hypothesized that low literate adults would make more errors on morphologically complex words as compared with single morpheme words. There was a significant difference in error percent totals: low literate adults made significantly more errors on morphologically complex words ($M = 11.72$) as compared with single morpheme words ($M = 2.43$), $t(94) = 6.97$, $p < .001$ (see Figure 1). This finding corresponds to past research with first-grade elementary-school aged children with less developed morphological awareness – adults have

Figure 1

Average Percentage of Errors on Morphologically Complex and Single Morpheme Words



greater difficulties reading morphologically complex words aloud as compared with reading simple words aloud (Anglin, 1993; Clark & Berman, 1987).

After confirming that low literate adults make more errors on morphologically complex words, I performed a one-way ANOVA with three levels of morphologically complex word types: inflected, derived, and compound words. I found a significant difference on the percentage of errors on morphologically complex word type, $F(2, 188) = 13.95$, $p < .001$. I ran paired t-tests to look at differences between different types of morphologically complex words: inflected vs. derived, inflected vs. compound, and derived vs. compound words. Based on previous research, I predicted that adults would make significantly more errors on derived words as compared with compound and inflected words. I also hypothesized that since adults have a tendency to leave off word endings when reading, the adults would make more errors on inflected words as compared with compound words. I found significant differences in error percentage totals with inflected vs. compound words as well as derived vs. compound words. Adults made significantly more errors on inflected words (M = 17.44) vs. compound words (M = 3.70), $t(94) = 5.59$, $p < .001$ (see Figure 2). Additionally, adults made significantly more errors on derived words (M = 14.28) vs. compound words (M = 3.70), $t(94) = -4.05$, $p < .001$ (see Figure 2).

There was no significant difference in the percentage error totals between inflected and derived words. Adults made approximately the same percentage of mistakes on inflected words (M = 17.44) as compared with derived words (M =

14.28), $t(94) = 1.03$, $p > .05$ (see Figure 2). This finding is surprising because past research with children indicates that errors are more common on derived words versus inflected words. Low literate adults actually produced more errors on inflected words although not significantly more than derived words. From this finding, I decided for low literate adults it was important to include both inflected and derived words in tasks for Experiment 2.

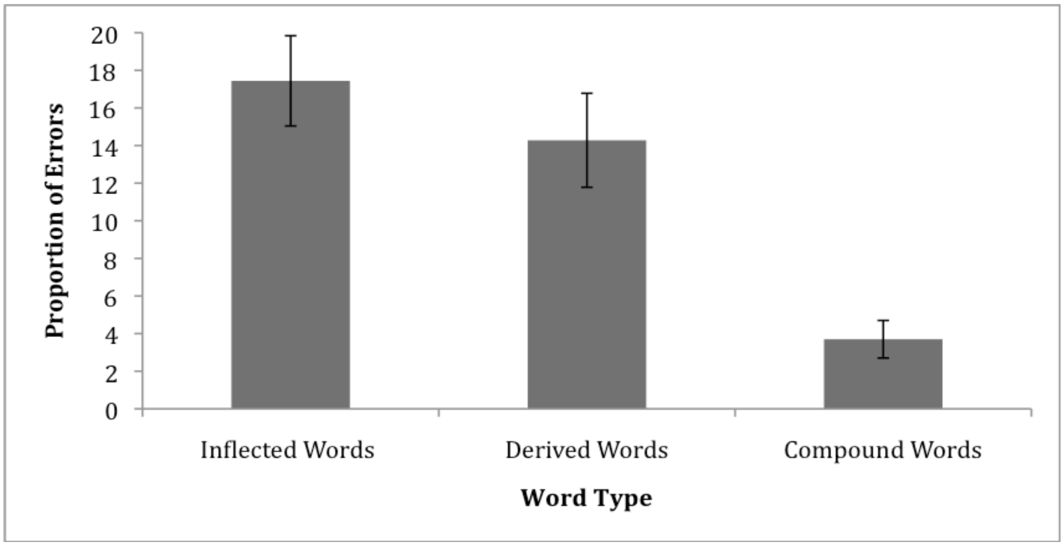
Second Language Learners

Since most ABE classrooms are comprised of a heterogeneous group of adults, I decided to perform a 3 Word Type x 3 Reader Type repeated measures/mixed model ANOVA to look at differences in the percentage of errors made on morphologically complex words between students of different language abilities. Word type included 3 levels: inflected, derived, and compound words. Reader type was also comprised of 3 levels: native English speakers, non-native literate adults (ESOL students with the ability to speak and read in native language), and non-native illiterate adults (ESOL students with only the ability to speak in native language).

Previous research on Spanish-speaking English language learners (ELLs – a term for children second language learners that is synonymous with the term, ESOL, for the adult population), indicates that ELL elementary school aged students have greater reading comprehension difficulties as compared with native English speakers. Researchers postulate that the gap between native and ELL

Figure 2

Average Percentage of Errors on Inflected, Derived, and Compound Words



students exists due to the ELL students' lower levels of morphological awareness and limited vocabulary knowledge (August, Carlo, Dressler, & Snow, 2005; Carlo, August, McLaughlin, Snow, Dressler, Lippman, Lively, & White, 2004; Kieffer & Lesaux, 2008). Keiffer & Lesaux (2008) investigated the relationship between reading comprehension and derivational morphology in fourth and fifth grade ELL students after controlling for word reading skills, phonological awareness, and breadth of vocabulary knowledge. Utilizing a morphological decomposition task adapted from Carlisle (2000), these researchers found deficits in ELL students' ability to recognize the base forms of derived words. The researchers concluded that derivational morphological awareness predicts reading comprehension in ELLs in the upper elementary school grades. Furthermore, the researchers suggest that the relationship between morphological awareness and reading comprehension may be similar for both ELLs and native speakers, but ELL students may have lower levels of derivational morphological awareness (Keiffer & Lesaux, 2008).

Second-language acquisition research has also addressed transfer effects from a native language as important to learning a second language (August, et al., 2005; Hancin-Bhatt & Nagy, 1994; Nunes & Bryant, 2009). Transfer effects refer to "…the influence resulting from similarities and differences between the target language and any other language that has been previously…acquired" (Odlin, 1989, p. 27). For example, Spanish and English share a large number of cognate pairs – vocabulary words that are similar orthographically and semantically (*information* and *información*). Hancin-Bhatt & Nagy (1994) found that Spanish ELLs that are skilled at recognizing cognates have higher levels of morphological awareness and are better at identifying unfamiliar English words in context. High levels of morphological awareness in many native languages (Portuguese, Hebrew, French, and Spanish) has been found to predict vocabulary learning and reading comprehension in learning English as a second language (Nunes & Bryant, 2009).

Based on the previous research on children ELLs, I hypothesized that the ESOL adults in the current study would have lower levels of morphological awareness as compared with native English speakers. I predicted that the ESOL adults, both non-native literate and non-native illiterate, would make more errors on all three types of morphologically complex words as compared with the native English speakers. Moreover, past research indicates that ELL students have particular difficulty with derived words (Keiffer & Lesaux, 2008). Thus, I predicted that the non-native speakers would have the greatest percentage of errors on derived words. Finally, research on child ELLs indicated that literacy and high morphological awareness in their native language would aid in acquiring proficiency in a second language (Hancin-Bhatt & Nagy, 1994). I postulated that although non-native literate students would make more errors as compared with native students, the non-native illiterate students would make the most errors of all three reading groups on all three types of morphologically complex words.

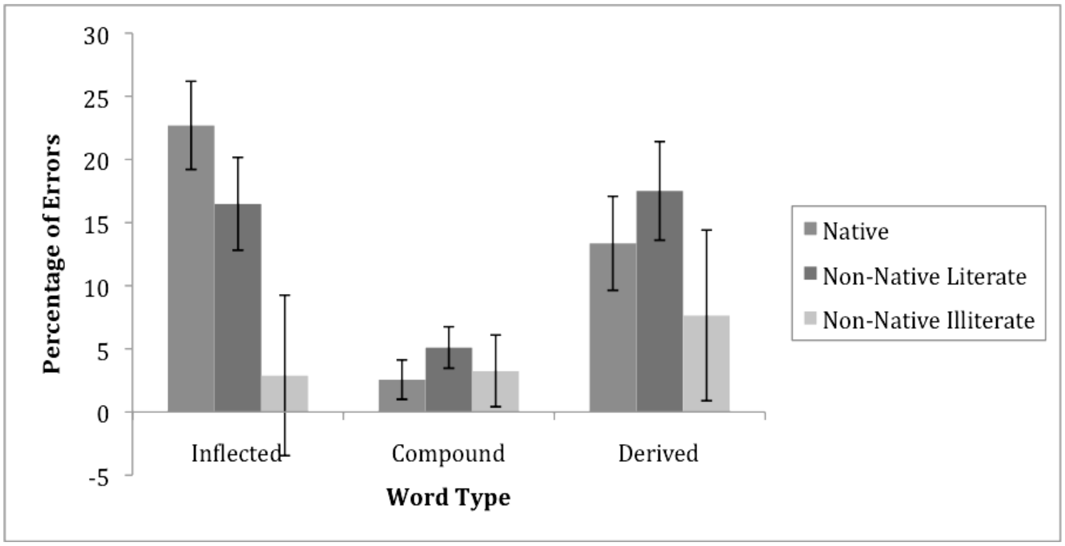
I found a significant main effect of word type, $F(2, 184) = 6.70$, $p < .05$. Similar to my previous findings, participants made significantly greater percentages of errors on inflected (M =14.03) and derived words (M = 12.84) as compared with compound words (M = 3.65). There were no significant differences between inflected and derived words.

There was no significant main effect of reader type, $F(2, 92) = 2.20$, $p >$ .05. Native, non-native literate, and non-native illiterate students showed no differences in percentages of errors when reading morphologically complex words. Thus, all three reading groups performed similarly when reading aloud the passage.

There were no significant interaction effects between word type and reader type. All three reading groups made a comparable percentage of errors on each of the three word types, $F(4, 184) = 2.01$, $p > .05$ (see Figure 3). These results indicated that differences in language abilities did not impact the percentage of errors made on different types of morphologically complex words. These findings are contradictory to previous research on child ELLs, non-native students made a smaller percentage of errors on all three word types as compared with native students. Furthermore, non-native illiterate made the smallest percentage of errors on derived words. These findings suggest ESOL adults may have comparable levels of morphological awareness to low literate native adults and that researchers can treat the ABE population as a homogenous group when addressing morphological skills.

Figure 3

Average Percentage of Errors of Native, Non-Native Literate, and Non-Native Illiterate Students on Inflected, Compound, and Derived Words



INTRODUCTION AND HYPOTHSES – EXPERIMENT 2

In Experiment 2, I addressed five primary questions: 1. How accurate are low literate adults on different types of morphological complex words compared with single morpheme control words in the oral reading of a passage?; 2. How accurate are low literate adults on different types of morphological complex words compared with single morpheme control words on a single word recognition computer task?; 3. How do reaction times compare across frequency and transparency measures?; 4. How do reactions times compare when preserving versus disrupting morpheme boundaries?; and 5. Does context influence accuracy?

To address the first question, the participants read a narrative composed of morphologically complex words – both inflectional words with *–s, -ing,* and *–ed* endings as well as derived words with high and low frequencies, high frequency two morpheme words matched with single morpheme words, and shift and stable words. All inflected words were matched with single morpheme control words based on frequency. Derived words were matched based on frequency and word length as adapted from the Carlisle and Stone (2005) study. A difference in accuracy between morphologically complex words and matched control words indicates a sensitivity to morphological complexity – readers spend longer and are less accurate processing more complex words. Thus, I hypothesized that adults would be more accurate on control words as compared with morphologically complex words on all word types. I predicted that adults would make the most errors on the reading of derived words; more specifically, the phonological shift and low frequency words. Past research has indicated that children read stable words and high frequency words more accurately as compared to shift words and low frequency words (Carlisle & Katz, 2006; Carlisle & Stone, 2005). I also hypothesized that omissions of inflectional endings would be a common error. Past studies have identified omissions as the most common error made by children. Furthermore, an *–ed* ending was omitted more frequently than an *–ing* ending in writing (Walker & Hauerwas, 2006; Smith-Lock, 1991). Based on this information, I expected that these results would be similar for low literate adults. Moreover, I deducted that errors in writing tasks translated to oral reading tasks.

To answer the second question, a computerized program was used to present the participant with individual words that were matched with the words in the oral reading passage – inflectional endings, high and low frequency derived words, and stable and shift derived words. A second computer task presented morphologically complex words adhering to morpheme boundaries as well as disrupting morpheme boundaries. For example, LOWest represents a word that adheres to the correct morpheme boundary while LOwest disrupts the morpheme boundary. For both tasks, the computer recorded the amount of time the participant needed to recognize the word; the researcher simultaneously recorded accuracy. I hypothesized that participants would demonstrate quicker and more accurate recognition of derived high frequency and stable words as compared with low frequency and shift words. I also predicted faster and more accurate identification of matched single morpheme words as compared with the inflected complex words. Moreover, I hypothesized that there would be no difference in reaction times between morphologically complex words which adhere to or disrupt morpheme boundaries due to the expectation that the adults had under-developed morphological knowledge. Past research has shown that lack of morphological knowledge and rules in learning disabled adults resulted in no difference in word recognition rates with the disruption of morpheme boundaries (Leong, 1999).

The final question pertained to identifying words in context versus words in isolation. The computer task presented words individually whereas the oral reading passage provided contextual clues to infer word meanings. I hypothesized that context would aid low literate adults in recognizing and reading unfamiliar words. Previous research has found that children rely on contextual clues and morphological knowledge to figure out novel words (Nagy & Anderson, 1984). Thus, I expected that contextual information would be more beneficial as a function of increasing morphological awareness with low literate adults.

METHOD – EXPERIMENT 2

Participants

The participants included 57 adults from the Massachusetts Career Development Institute (MCDI), an adult basic education program located in Western Massachusetts during the fall of 2009. Participants consisted of males and females from a wide range of ages and diverse ethnic backgrounds. The participants included 12 from the ESOL level three class, 13 from the pre-GED (equivalent of fifth to eighth grade level) class, and 32 from the GED (ninth to twelfth grade level). Of the 57 participants, only 52 completed both days of testing.

Materials

Participants were read aloud an informed consent form to make sure they understood the nature of the study and the procedures regarding their agreement to participate (see Appendix B). Participants were administered an oral reading passage and two computerized word recognition tasks. Additionally, a battery of tests consisting of several tasks to assess basic language skills was utilized. The battery encompassed tests covering morphological and phonological skills and knowledge as well as an overall reading ability measure. These tests were administered to gain a greater sense of skills as well as to control for phonological awareness so as to see the impact of morphological awareness in the primary tasks.

Oral Reading Passage

A passage similar to the DIBELS ORF was constructed with particular attention to different inflectional endings and types of derived words. The passage included words with -*s, -ing,* and *–ed* inflectional endings, which were matched based on frequency with single morpheme control words utilizing the Standard Frequency Index. The passage also included derived words from the Carlisle and Stone (2005) study – high frequency, two morpheme words matched with pseudo complex derived, single morpheme words ("winner" and "dinner"); low-frequency derived words with high frequency bases matched with high frequency, high frequency base words ("sparkly" and "icy"); and stable versus phonological shift words matched on frequency and word length ("cultural" and "natural") (see Appendix C).

Participants were asked to read the entire passage aloud while the researcher simultaneously tape recorded and marked errors on a score sheet. The same passage was administered to all participants. Number of errors were recorded on a scorescheet – "1" for correct and "0" for incorrect.

Word Recognition Tasks

In the first task, participants were shown individual words on a computer screen adapted from the same Carlisle and Stone (2005) lists used in the oral reading passage as well as inflectional words matched using the Standard Frequency Index (SFI). Matched derived words not utilized in the oral reading passage were included in the word recognition task in order to keep the same controls between the two tasks. The same three types of inflectional endings (-*s*, -*ing,* -*ed*) were included and matched utilizing the SFI with words from the passage (see Appendix D). The participant read all the words presented on the screen aloud and the E-Prime computer program recorded the rate of word recognition. The researcher kept track of errors. Task one included 42 words presented each presented in isolation for a duration of five seconds.

The second task presented participants with morphologically complex words that either had a correct or incorrect morpheme boundary as utilized by the Leong (1992) and Leong (1999) studies (see Appendix D). Participants were asked to read the words aloud while the computer program recorded the rates. Words were counterbalanced between two lists and one of the lists was randomly assigned to participants. For example, list one included the word reTURN (adhering to morpheme boundary) but TEACher had an incorrect boundary whereas list two included the reverse: retURN (incorrect boundary) and TEACHer had the correct morpheme boundary. Each list contained 10 words, 5 with proper boundaries and 5 with incorrect morpheme boundaries and words were presented individually for a duration of five seconds each.

Morphological Awareness

I incorporated the three tests described below to assess morphological awareness.

Base Form Morphology (BMorph) Task

This test, utilized by Leong (2000) and derived from Carlisle (1988), aimed to assess morphological structure by recognition of the root word of derived target words. The participant decomposed derivational target words into base words. The examiner read aloud a derived target word, which served as a prime for the participant. Next, the examiner read a short sentence with a blank at the end. The participant was expected to fill in the blank with the base word of the target word given in the beginning of the sentence. There were 4 different conditions: no-change, orthographic-change, phonological-change, and a both-change. For example a no change meant that the base word and the derivational form look and sound the same: “Growth. She wanted her plant to _____.”; “grow”. An orthographic-change represented a shift in spelling such as a double consonant: “Foggy. They could not see very far because of the heavy ______”; “fog”. A phonological-change consisted of a vowel change: “Popularity. The girl wants to be ______.”; “popular”. Finally, a both-change encompassed both an orthographic and phonological shift: “Width. The mouth of the river is very _______”; “wide” (see Appendix E). Every correct answer the participant provided received one point and an incorrect or no answer received zero points. Participants were given a practice round of two items and then completed seven sentences in each condition for a total of 30 items. The test was discontinued if the participant made six errors.

Derived Form Morphology (DMORPH) Task

This task was also adapted from Leong (2000) and was similar in layout to the BMORPH task. The task assessed an individual's ability to transform a base word into a derived word. The examiner provided participants with a base word followed by a sentence concluding with a blank. The participant was asked to fill in the blank with the proper derived form of the word. The same four conditions were used as in the BMORPH: no-change, orthographic-change, phonological-change, and a both change. For example, "Final. After trying many times he won the game_______"; "finally" was considered a no-change. An orthographic-change example looked like this: "Happy. Money does not buy _______"; "happiness". A phonological change: "Equal. Boys and girls are treated with ________"; "equality". A both-change: "Explain. His excuse was a bad _______"; "explanation" (see Appendix E). Similarly, correct answers received one point and incorrect or no answers received zero points. A practice round was included and participants completed seven sentences in each condition for a total of 30 items. The test was discontinued if the participant made six errors.

Derivational Suffix Choice Test of Pseudowords

Developed by researchers at the University of Washington (1999) and utilized in the Singson, Mahony, and Mann (2000) study, this test was designed to assess an individual's ability to manipulate morphemes using non-words. The test was given to the participant in written form and administered orally so as to avoid reading difficulties. The test displayed a sentence with a blank and the participant was prompted to select the appropriate answer from four listed choices. For example, “Our teacher taught us how to _______ long words. Answer choices included *jittling, jittles, jittled,* and *jittle* (see Appendix E). The correct response, “jittle”, received one point while an incorrect answer or lack of an answer resulted in zero points. Participants were given 14 of these items; however, the test was discontinued if the participant answered six questions incorrectly.

Phonological Awareness

I utilized two tests to measure phonological awareness – one for pseudowords and one for real words. These tasks are described below.

Woodcock Reading Mastery Tests – Revised (WRMT-R)

Phonological abilities were measured using the Word Attack subtest of the WRMT-R (Woodcock, 1987). The Word Attack subtest assesses individual’s phonological decoding ability of non-words. The participant was presented with 45 non-words, such as *nat* or *ib*, and asked to read them aloud. A correct response elicited a point only if the whole word is pronounced correctly. No response, incorrect syllable pronunciation, or reading the syllables disjointedly resulted in no points (see Appendix F). The test was discontinued if the participant incorrectly answered six questions.

DIBELS Phoneme Segmentation Fluency (PSF)

The PSF subtest of the DIBELS measures phonological awareness by testing the ability to break real words into their subsequent phonemes. The examiner presented a word orally to the participant and asked the participant to say all the sounds in the word. For example, if given the word "mop", the correct response would be "/m/ /o/ /p/" (see Appendix F). Participants were timed for one minute and told to sound out as many words as possible in that time. Participants needed to say each individual sound to receive full credit. The correct number of phonemes per minute determined the phoneme segmentation fluency rate (Good, & Kaminski, 2002).

General Reading Ability Test

The Letter-Word Identification and Passage Comprehension subtests of the Woodcock Reading Mastery Tests – Revised (WRMT-R) were administered to measure general reading abilities (Woodcock, 1987). Letter-Word Identification assesses participant's ability to recognize and pronounce individual letters and words. Participants were shown a binder containing pages with letters and groups of single words and asked to identify specific words/letters. The words increased in difficulty as the task progressed. The test was suspended if participants answered six words incorrectly (see Appendix G).

The Passage Comprehension subtest is designed to measure readers' ability to understand words sentences by asking participants to rely on pictures and contextual cues. First, participants were presented with a series of pictures with written words and asked to pick the picture, described by the written words (see Appendix G for some examples with pictures). Next, the participant was presented with sentences, each with a missing word, which participants were asked to supply. Either a picture or contextual cues within the sentence were provided to enable the participant to fill in the missing word. For example, “The drums were pounding in the distance. We could ____ them”. Participants were expected to supply the correct answer, “hear”, and testing was suspended if participants provided six incorrect responses (see Appendix G). The full WRMT-R battery is lengthy and expensive to administer thus, I thought the two chosen subtests of the battery were sufficient to assess basic reading abilities of the participants.

Procedure

The tasks were administered to the participants in two 30 minute sessions over a two-day span. One session included the oral reading passage, the DIBELS PSF subtest, Word Attack, Letter-Word Identification, and the DMORPH tasks. The other session included both of the computer word recognition tasks, Derivational Suffix Choice Test, Passage Comprehension, and the BMORPH tasks. The order of the sessions as well as the order of the tasks within the sessions was counterbalanced. Testing took place in a quiet classroom at the center and participants received $15.00 at the end of the second testing session as compensation for their time.

RESULTS – EXPERIMENT 2

Descriptive Statistics of Predictor and Outcome Variables

I collected data on 10 different tasks that are thought to represent different aspects of literacy knowledge. The literacy constructs included phonological awareness tasks, morphological awareness tasks, and reading comprehension tasks. Table 1 lists the means and standard deviations of all predictor variables from the battery of literacy assessments. The means and standard deviations for the outcome variables from the oral reading passage and computer tasks can be found in Tables 2 and 3. I included the means and standard deviations for total inflected words (*-s, -ed, -ing* word endings) as well as total derived words (high frequency, low frequency, shift, and stable words). Additionally, Table 4 lists means and standard deviations in milliseconds for the raw computer task reaction times (without outliers removed). Table 5 lists outliers removed due to computer malfunction, which included all times above 3,000 milliseconds and below 200 milliseconds. Finally, means and standards with outliers removed that were over two standard deviations are listed in Table 6.

Correlations Between Literacy Assessments

The purpose of the study was to assess how general reading abilities, phonological, and morphological skills predict morphological awareness of low literate adults on a reading passage as well as a single-word recognition computer task. I expected that all of these literacy abilities would be positively correlated. Table 7 shows that in fact all of these predictor variables were positively

Table 1

Means and Standard Deviations of Predictors

	M	SD
DMORPH	14.55	8.31
BMORPH	22.70	7.79
Suffix Choice	7.00	3.89
MA Total	43.81	17.71
DIBELS PSF	24.91	11.10
Word Attack	20.65	6.79
PA Total	45.56	15.83
Letter Word	56.47	8.79
Passage Comprehension	27.87	5.71

Table 2

Means and Standard Deviations of Outcome Variables (Oral Reading Passage)

	M	SD
S Words	6.78	1.54
S Matched Words	7.27	0.99
Ed Words	6.96	1.72
Ed Matched Words	7.69	0.63
Ing Words	5.72	0.68
Ing Matched Words	5.67	0.92
Inflected Words Total	19.47	3.44
Morphologically Complex Words	6.15	1.24
Pseudo Complex Matched Words	6.49	0.72
Low Frequency Words	5.93	1.36
Phonological Shift Words	7.13	1.62
Stable Words	7.75	1.62
Derived Words Total	26.95	4.75

Table 3

Means and Standard Deviations of Outcome Variables (Computer Tasks)

	M	SD
S Words	2.39	0.71
S Matched Words	2.96	0.19
Ed Words	2.41	0.74
Ed Matched Words	2.96	0.19
Ing Words	2.69	0.61
Ing Matched Words	2.83	0.42
Inflected Words Total	7.48	1.58
Morphologically Complex Words	4.56	0.63
Pseudo Complex Matched Words	4.83	0.50
Low Frequency Words	3.85	1.35
Phonological Shift Words	1.46	1.31
Stable Words	3.26	0.87
Derived Words Total	13.13	2.81
Correct Boundary Words	4.74	0.56
Incorrect Boundary Words	4.78	0.57

Table 4

Means and Standard Deviations of Raw Computer Reaction Times (in milliseconds)

	M	SD
S Words	773.69	295.95
S Matched Words	821.32	508.28
Ed Words	712.98	273.85
Ed Matched Words	765.06	301.64
Ing Words	911.18	437.24
Ing Matched Words	794.86	382.25
Inflected Words Total	2381.60	756.35
Morphologically Complex Words	865.69	394.33
Pseudo Complex Matched Words	732.58	278.27
Low Frequency Words	1101.75	450.74
Phonological Shift Words	860.49	285.78
Stable Words	979.46	426.24
Derived Words Total	3645.65	1139.50
Correct Boundary Words	798.18	243.77
Incorrect Boundary Words	807.45	329.56

Table 5

Means and Standard Deviations of Computer Reaction Times (Outliers due to Malfunction Removed, in milliseconds)

	M	SD
S Words	724.52	222.54
S Matched Words	673.11	225.44
Ed Words	743.38	354.06
Ed Matched Words	736.14	228.52
Ing Words	887.77	386.75
Ings Matched Words	748.77	211.73
Inflected Words Total	2300.40	671.14
Morphologically Complex Words	771.35	232.13
Pseudo Complex Matched Words	701.64	232.13
Low Frequency Words	1050.19	390.17
Phonological Shift Words	846.53	235.01
Stable Words	901.73	299.23
Derived Words Total	3402.54	879.57
Correct Boundary Words	777.29	210.47
Incorrect Boundary Words	751.27	211.89

Table 6

Means and Standard Deviations of Computer Reaction Times (Outliers Above Two Standard Deviations Removed, in milliseconds)

	M	SD
S Words	687.21	185.26
S Matched Words	626.73	164.71
Ed Words	676.98	163.38
Ed Matched Words	707.41	187.56
Ing Words	745.95	192.95
Ing Matched Words	734.27	192.69
Inflected Words Total	2077.14	474.54
Morphologically Complex Words	730.55	159.18
Pseudo Complex Matched Words	675.98	166.93
Low Frequency Words	925.18	208.84
Phonological Shift Words	830.04	214.90
Stable Words	786.20	181.02
Derived Words Total	3144.49	597.10
Correct Boundary Words	727.02	152.41
Incorrect Boundary Words	708.47	161.04

correlated. These findings are consistent with previous research with children, which has found positive correlations between reading comprehension and fluency, phonological, and morphological abilities.

I predicted that the three morphological awareness tasks – DMORPH, BMORPH, and Suffix Choice – would be more highly related to one another as compared with the other literacy assessments. In fact, the morphological variables were highly correlated – DMORPH and BMORPH (.68), BMORPH and Suffix Choice (.66) and DMORPH and Suffix Choice (.74). Similarly, I expected that the two phonological awareness tasks – DIBELS PSF and Word Attack would be highly related to each other. Phonological awareness tasks were highly correlated – DIBELS PSF and Word Attack (.54). Since morphological tasks were correlated with each other, I decided to combine the three scores into a single score for each participant – referred to as morphological awareness (MA). The Cronbach's Alpha coefficient for the three items was a .82, suggesting that these measures have high internal consistency in measuring MA. Likewise, I combined the two scores from the phonological tasks – referred to as phonological awareness (PA). The Cronbach's Alpha coefficient for the two items was a .65, suggesting that these measures have a relatively high internal consistency in measuring PA. I left the two general reading ability tasks – Letter Word Identification and Passage Comprehension – as separate scores because these measures assessed different skills – identifying words in isolation versus filling in words in sentences based on context (see Table 7).

Table 7

Correlation Coefficients Between Literacy Assessments

Tasks	1	2	3	4	5	6	7	8	9
1. DMORPH	--	.68**	.74**	.92**	.47**	.58**	.75**	.58**	.77**
2. BMORPH	--	--	.66**	.90**	.45**	.46**	.60**	.51**	.71**
3. Suffix Choice	--	--	--	.84**	.39**	.63**	.66**	.54**	.69**
4. MA Total	--	--	--	--	.49**	.60**	.74**	.60**	.81**
5. DIBELS PSF	--	--	--	--	--	.54**	.49**	.93**	.57**
6. Word Attack	--	--	--	--	--	--	.68**	.81**	.51**
7. Letter Word	--	--	--	--	--	--	--	.63**	.60**
8. PA Total	--	--	--	--	--	--	--	--	.62**
9. Passage Comp	--	--	--	--	--	--	--	--	--

Note: There were 55 participants included for DMORPH, Word Attack, DIBELS, Letter Word, and PA. There were 54 participants included for BMORPH, Suffix Choice. There were 52 participants included for MA. $^{**}p<.01$.

Regressions of Morphological and Phonological Awareness on Reading Abilities

I performed a multiple regression with my combined phonological awareness scores, combined morphological awareness scores, and Letter Word Identification as the predictors and Passage Comprehension as the outcome variable. I decided to utilize Passage Comprehension as an outcome variable because this standardized assessment serves as a general reading comprehension measure and based on past research it is important to assess the contributions of phonological and morphological abilities to reading comprehension skills. Based on past research with children, I expected that both morphological awareness and phonological awareness would be significant predictors of reading abilities with low literate adults. The regression equation was significant, $F(3, 48) = 35.89$, $p < .001$, accounting for 69.2% of the variance. Both morphological awareness and phonological awareness were significant unique predictors but Letter Word Identification was not a unique predictor of reading ability (see Table 8).

In addition to examining how different phonological and morphological skills predict reading ability, I wanted to determine how much additional variance morphological awareness would contribute to the explanation of reading ability above phonological awareness. In order to address this, I performed a hierarchical regression with Passage Comprehension still as the outcome measure. In the first block, I entered only phonological awareness and the regression was significant, $F(1, 50) = 31.33$, $p < .001$, accounting for 38.5% of the variance. In the second block I included morphological awareness, to see if this addition significantly altered R^2. The overall regression was significant, $F(2, 49) = 53.78$, $p < .001$. Furthermore, morphological awareness explained 30.2% of the variance beyond phonological awareness. Thus, the regressions revealed support for my hypotheses that morphological awareness and phonological awareness were both significant unique predictors of reading comprehension. Moreover, morphological awareness contributed to reading comprehension after controlling for phonological awareness.

Analysis of Variance – Accuracy on Types of Morphologically Complex Words

One of my primary questions addressed the word identification accuracy on types of morphologically complex words between words in context (oral reading passage) and isolated words (computer task). Since all participants were administered both tasks and all different types of morphologically complex words, I performed 2 Morphological Complexity x 2 Task Type Repeated Measures ANOVAs to investigate accuracy levels within-participants. Morphological complexity was comprised of two levels: morphologically complex words versus control words. Task type included the oral reading passage and the single word recognition computer task. The six pairs of words in each task were: *–s* versus *–s* matched, *-ed* versus *–ed* matched, *-ing* vs. *–ing* matched, morphologically complex (high frequency) versus pseudo complex (high frequency) matched words, low frequency morphologically complex words with high frequency bases versus high frequency base matched words, and phonological shift versus stable words. Since there were different total numbers

Table 8

Regression Analysis of Phonological and Morphological Awareness on Reading Comprehension

Tasks	*B*	*t*
Phon. Awareness	.24*	2.29
Morph. Awareness	.75**	6.01
Letter Word	-.11	-.85

Note: There were 52 participants included. *$p < .05$ **$p < .01$

of types of words between the passage and the computer tasks, I computed percent variables. By performing ANOVAs with the proportion of morphologically complex words as the dependent variable, I was able to control for differences in total number of words between the reading passage and computer task.

I found significant main effects of morphological complexity for five of the six types of words. Participants were significantly more accurate at reading the matched control words (-*s* matched, -*ed* matched, pseudo complex matched, high frequency base matched, and stable words) as compared with the inflected, low frequency, and phonological shift words. This was supported by a significant main effect of morphological complexity: -*s* words vs. -*s* matched, $F(1, 51) = 38.78$, $p < .001$; -*ed* words vs. -*ed* matched, $F(1, 51) = 31.48$, $p < .001$; morphologically complex vs. pseudo complex, $F(1, 51) = 15.65$, $p < .001$; low frequency, high frequency base vs. high frequency base matched, $F(1, 51) = 52.12$, $p < .001$; and phonological shift vs. stable, $F(1, 51) = 103.32$, $p < .001$. These results indicate that low literate adults are sensitive to morphologically complex words and that altering frequencies and transparencies influence word recognition. There was no main effect of morphological complexity for -*ing* versus –*ing* matched words, $F(1, 51) = 2.82$, $p > .05$. Therefore, -*ing* words were read as accurately as the control matched words.

There were significant main effects of task type for the derived words – three of the six total word types (morphologically complex vs. pseudo complex words, low frequency, high frequency bases vs. high frequency base matched, and phonological shift vs. stable words). Participants were significantly more accurate reading these words in context (i.e. oral reading passage) as compared with reading them in isolation (i.e. computer task): morphologically complex vs. pseudo complex matched, $F(1, 51) = 4.43$, $p < .05$; low frequency vs. high frequency base matched, $F(1, 51) = 17.76$, $p < .001$; and phonological shift vs. stable words, $F(1, 51) = 62.95$, $p < .001$. The three types of inflected words displayed no main effect of task type: *-s* vs. *-s* matched, $F(1, 51) = .38$, $p > .05$; *-ed* vs. *-ed* matched, $F(1, 51) = 1.61$, $p > .05$; and *–ing* vs. *-ing* matched, $F(1, 51) =3.06$, $p > .05$. Thus, participants performed similarly on inflected words and their matched controls in both the oral reading passage and the computer task.

There were significant interaction effects between task type and morphological complexity for four of the six word types. For these types, adults performed more accurately on the control words (*–s* and *-ed* matched controls, pseudo complex, and stable words) as compared with the morphologically complex words (*-s*, *-ed*, low frequency, and phonological shift words respectively) however; the magnitude of difference in accuracy between morphologically complex words and controls in the isolated word reading task was significantly larger than the magnitude of difference in accuracy between morphologically complex words and controls when those words were found in context: *-s* vs. *-s* matched (see Figure 4), $F(1, 51) = 13.18$, $p < .01$, $t(54) = -2.76$, $p < .05$ (passage), $t(53) = -6.12$, $p < .001$ (computer); *-ed* vs. *-ed* matched (see

Figure 5), $F(1, 51) = 6.10$, $p < .05$, $t(54) = -3.41$, $p < .01$ (passage), $t(53) = -5.15$, $p < .001$ (computer); low frequency vs. high frequency base matched (see Figure 6), $F(1, 51) = 37.76$, $p < .001$, $t(54) = 1.37$, $p > .05$ (passage), $t(53) = 3.67$, $p < .01$ (computer); and phonological shift vs. stable (see Figure 7), $F(1, 51) = 75.36$, $p < .001$, $t(54) = -3.26$, $p < .01$ (passage), $t(53) = -10.69$, $p < .001$ (computer). These results demonstrate that low literate adults are sensitive to morphological complexity in different word types and are more accurate recognizing words in context as compared with in isolation. Consistent with past research, participants were able to utilize contextual information and morphological awareness to aid word identification.

There were no significant interaction effects between task type and morphological complexity for two types of words: *-ing* vs. *-ing* matched and morphologically complex vs. pseudo complex matched. Adults were not significantly more accurate with words in context versus words in isolation and performed similarly on *-ing* and pseudo complex matched controls as compared with the *-ing* and morphologically complex words. Therefore, there was no significant difference in the magnitude of difference in accuracy between morphologically complex words and controls in the isolated reading task as compared with the magnitude of difference in accuracy between morphologically complex words and controls in words read in context: *-ing* vs. *-ing* matched words (see Figure 8), $F(1, 51) = 3.89$, $p > .05$, $t(54) = .60$, $p > .05$ (passage), $t(53) = -2.21$, $p < .05$ (computer); and morphologically complex vs. pseudo complex matched (see Figure 9), $F(1, 51) = .21$, $p > .05$, $t(54) = -2.35$, $p < .05$ (passage), $t(53) = -3.11$, $p < .01$ (computer).

Figure 4

Mean Accuracy of S and S Matched Words

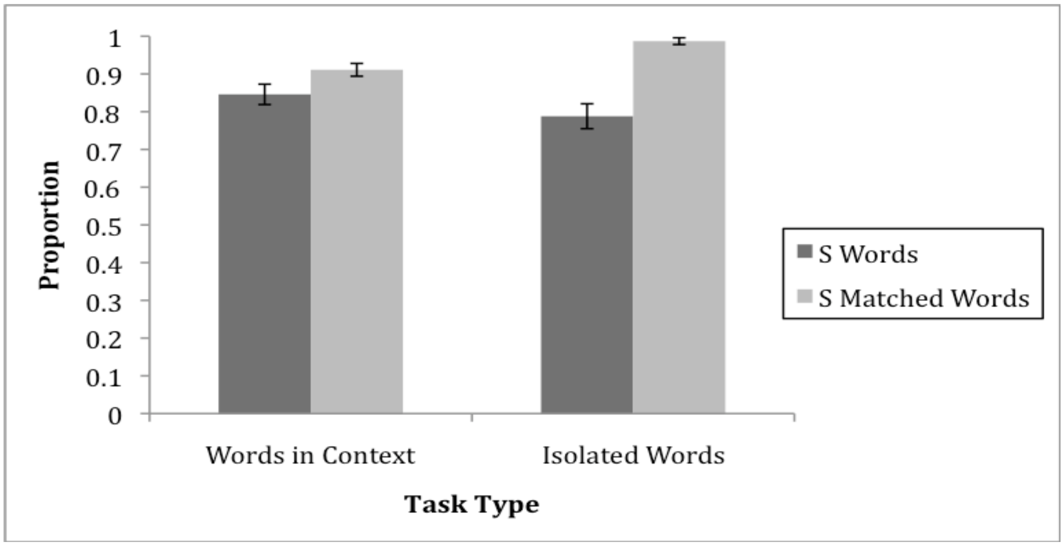


Figure 5

Mean Accuracy of Ed and Ed Matched Words

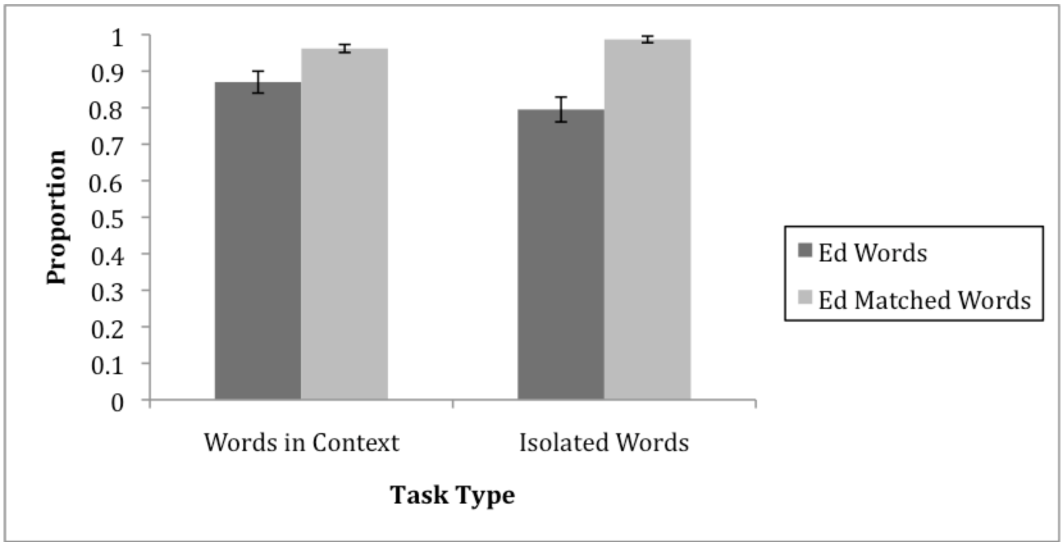


Figure 6

Mean Accuracy of Low Frequency (High Frequency Base) and High Frequency Base Matched Words

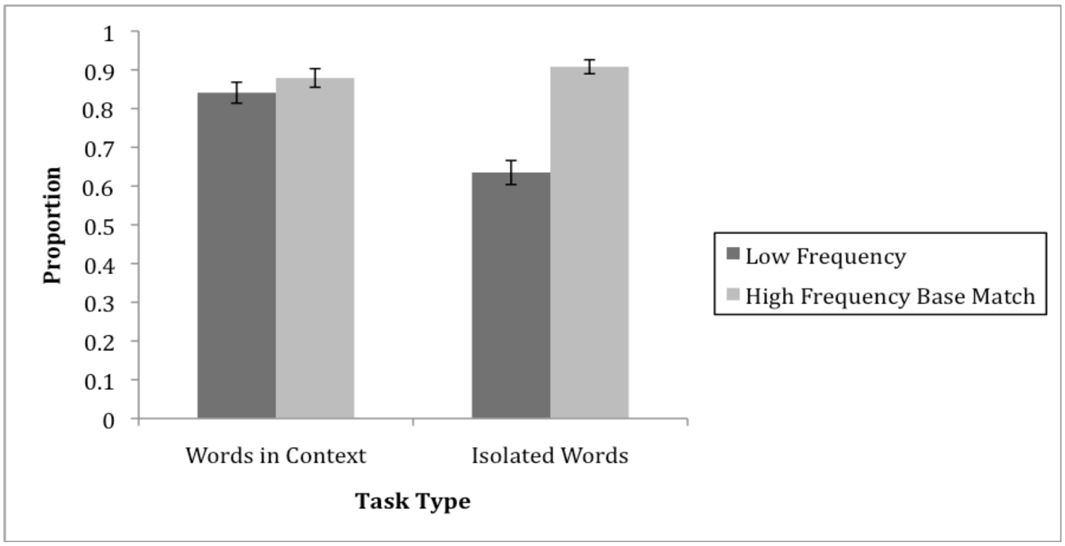


Figure 7

Mean Accuracy of Phonological Shift and Stable Words

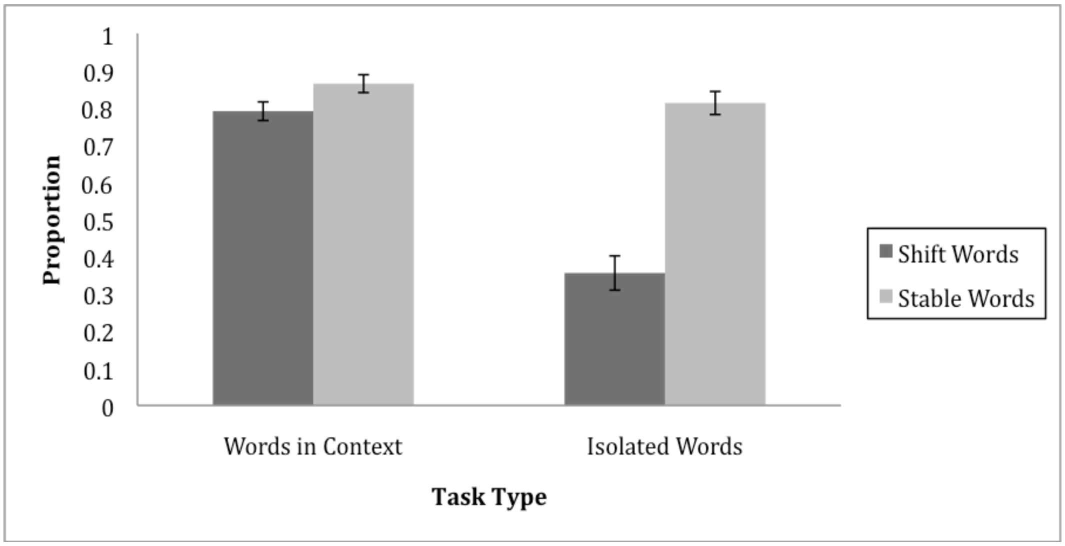


Figure 8

Mean Accuracy of Ing and Ing Matched Words

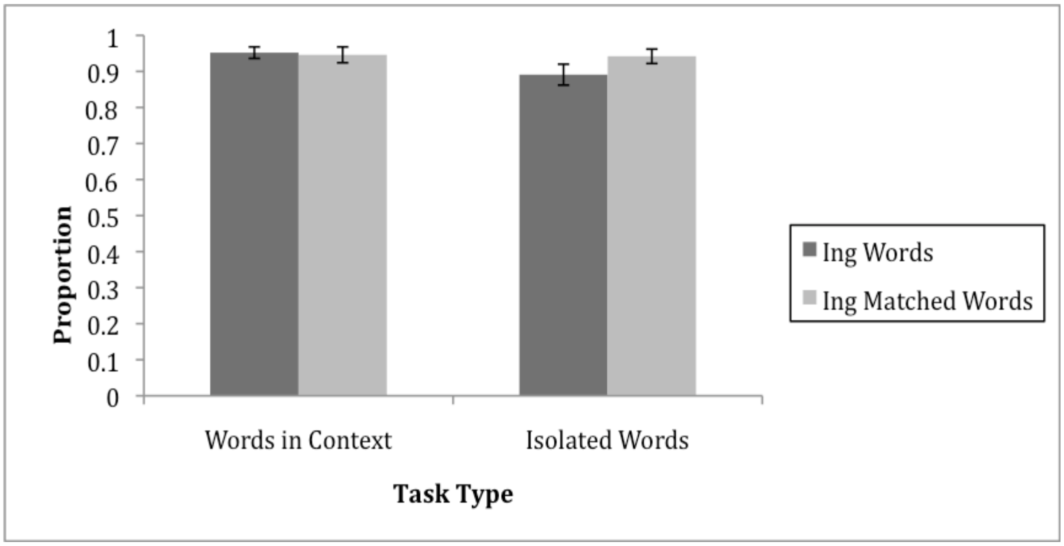
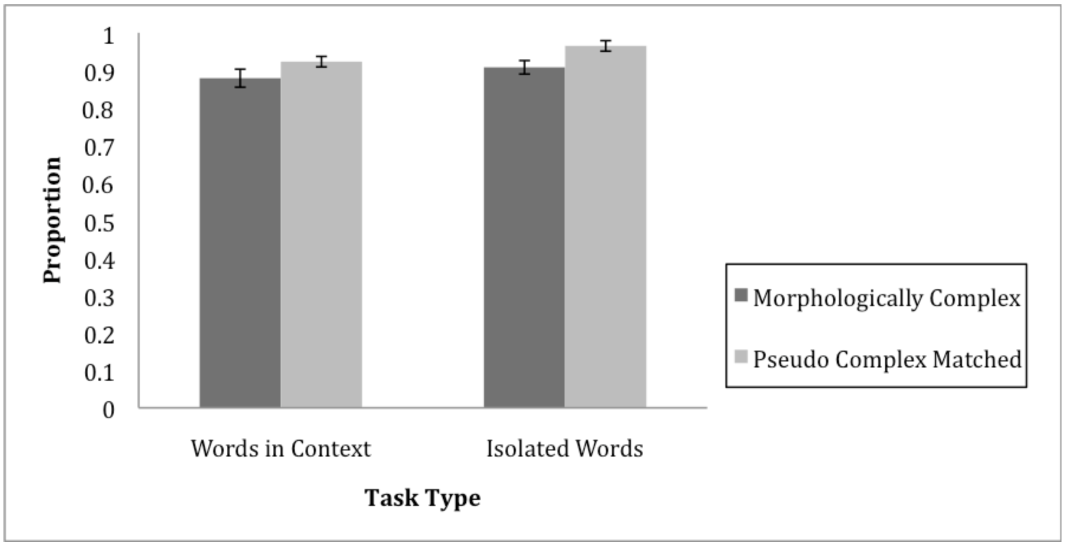


Figure 9

Mean Accuracy of Morphologically Complex (High Frequency) and Pseudo Complex (High Frequency) Matched Words



Paired Samples T-Test – Computer Reaction Times

Reaction time data was re-coded three different ways in order to obtain the most valid times. First, I averaged participants' times for each of the word types (-*s* vs. –*s* matched, -*ed* vs. –*ed* matched, -*ing* vs. –*ing* matched, morphologically complex vs. pseudo complex matched, low frequency vs. high frequency base matched, phonological shift vs. stable, and correct boundary vs. incorrect boundary words) and eliminated any reaction times for words that were read incorrectly. For example, participants received three –*s* words – if all were read correctly the participant received a single score based on the average of times on all three words. If one of the –*s* words was read incorrectly, the participant received a single time based on the average of the two correct words.

Next, I removed outliers due to equipment malfunctions. I classified words that were under 200 milliseconds and above 3,000 milliseconds as a result of a malfunction. For computer task 1 I took out 71/1,841 or 3.86% of words and for computer task 2 (boundary task) I eliminated 9/514 or 1.75% of words. For my final re-coding, I purged outliers above two standard deviations from the mean. For computer task 1, I removed an additional 83 words or 4.69% and for computer task 2 I got rid of an additional 23 words or 4.55%. I think my final coding of reaction times reflects the most accurate averages for word types without eliminating too many data points.

I performed paired samples t-tests to compare reaction times on morphologically complex words vs. the matched control words. I hypothesized that reaction times would be faster on the control words as compared with the morphologically complex words for all word types. There were significant differences in times for four of the six types. The control *-s* matched words (M = 626.73) were read significantly faster than the *-s* words (M = 687.21), $t(53)$ = 3.09, $p < .05$ (see Figure 10). Pseudo complex matched words (M = 675.98) were identified significantly faster than morphologically complex words (M = 730.55), $t(53)$ = 3.91, $p < .001$ (see Figure 11). High frequency base matched words (M = 721.16) were recognized significantly faster than low frequency words (M = 925.18), $t(51)$ = -8.66, $p < .001$ (see Figure 12). Finally, stable words (M = 745.62) were processed significantly faster than phonological shift words (M = 832.22), $t(32)$ = 2.40, $p < .05$ (see Figure 13). The paired t-tests show that the low literate adults were sensitive to morphological complexity, processing matched controls significantly faster than morphologically complex words. Additionally, adults were sensitive to differences in frequencies and transparencies – recognizing high frequency words with high frequency bases faster than low frequency words with high frequency bases and phonologically transparent words faster than phonological shift words.

There were no significant differences in reaction times between morphologically complex words and control words for *-ing* vs. *-ing* matched or *-ed* vs. *-ed* matched. On average, *-ing* words (M = 745.95) were processed at the same speed as *-ing* control words (M = 718.38), $t(51)$ = 1.40, $p > .05$ (see Figure

14). The *-ed* words (M = 676.98) were read at approximately the same speed as the *-ed* control words (M = 697.04), $t(52) = -1.18$, $p > .05$ (see Figure 15).

I also performed a paired samples t-test to compare reaction times for correct morpheme boundaries vs. incorrect morpheme boundaries. I predicted that there would be no difference in reaction times between correct and incorrect boundaries because I assumed low literate adults would lack knowledge and sensitivity to morphological rules. Words with correct morpheme boundaries (M = 727.02) were identified at approximately the same speed as words with incorrect morpheme boundaries (M = 708.47), $t(53) = 1.14$, $p > .05$ (see Figure 16). This finding is consistent with prior research in that readers with low morphological awareness will exhibit no difference in reaction times between words adhering to or disrupting morpheme boundaries.

Figure 10

Average Reaction Times of S and S Matched Words

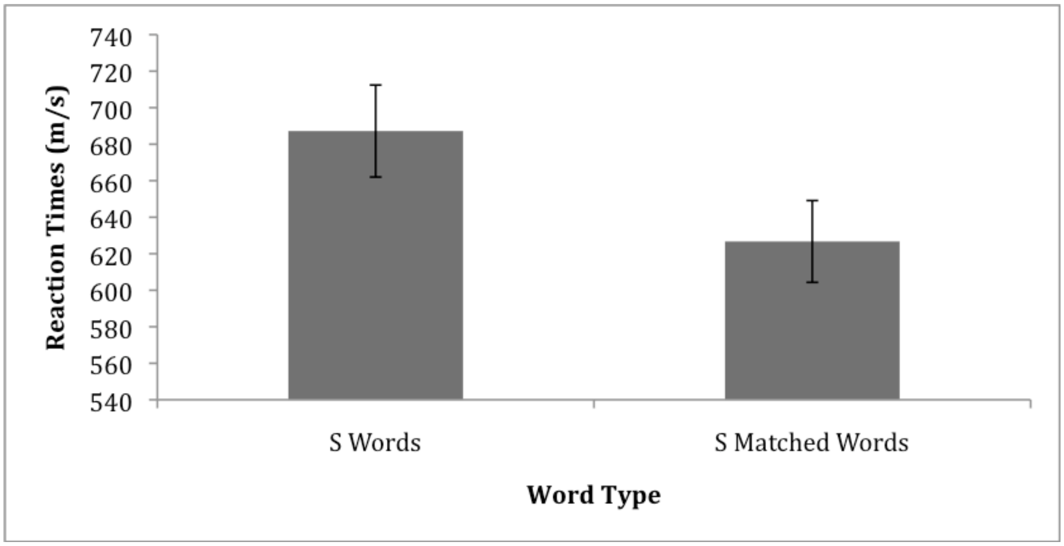


Figure 11

Average Reaction Times of Morphologically Complex and Pseudo Complex Matched Words

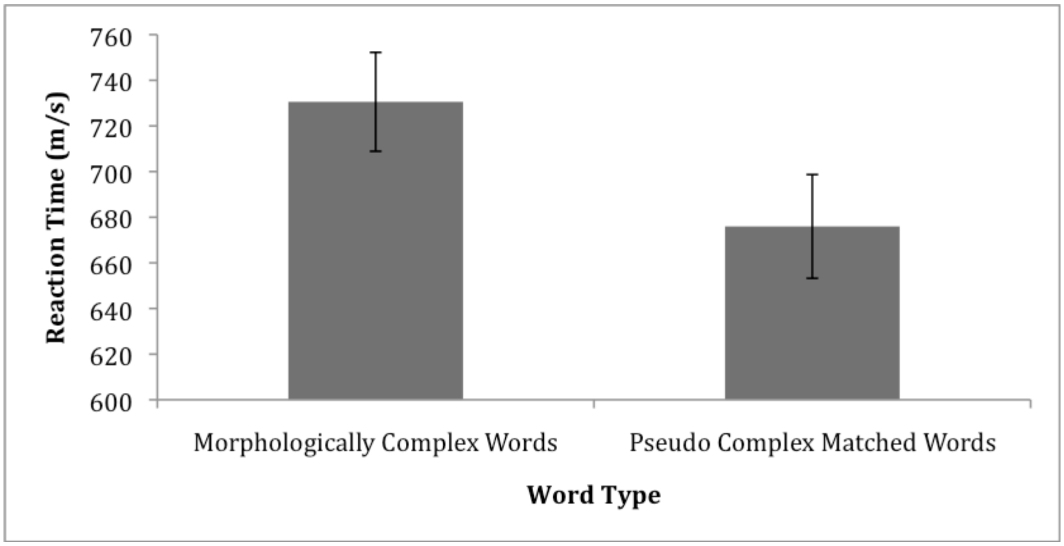


Figure 12

Average Reaction Times of Low Frequency and High Frequency Base Matched Words

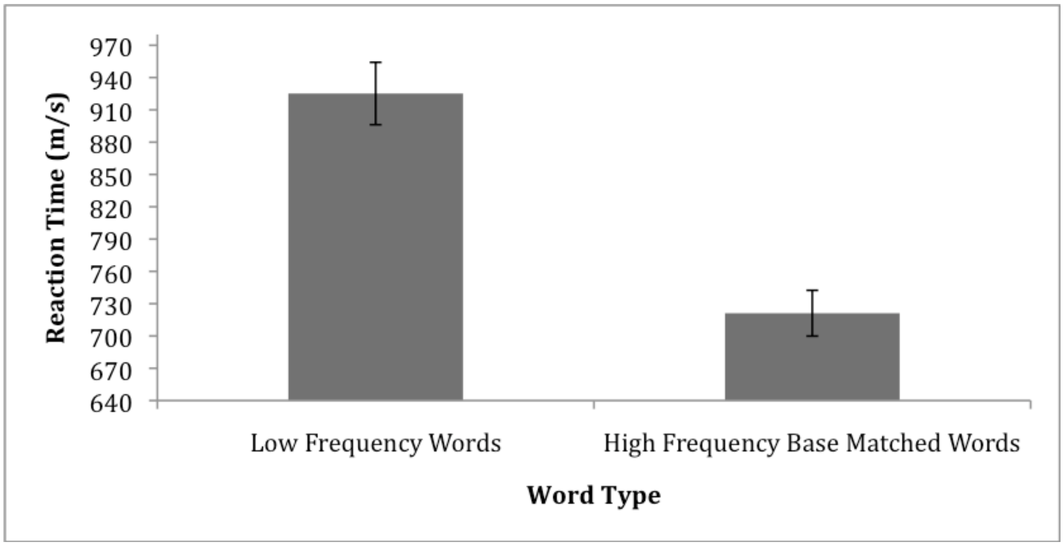


Figure 13

Average Reaction Times of Phonological Shift and Stable Words

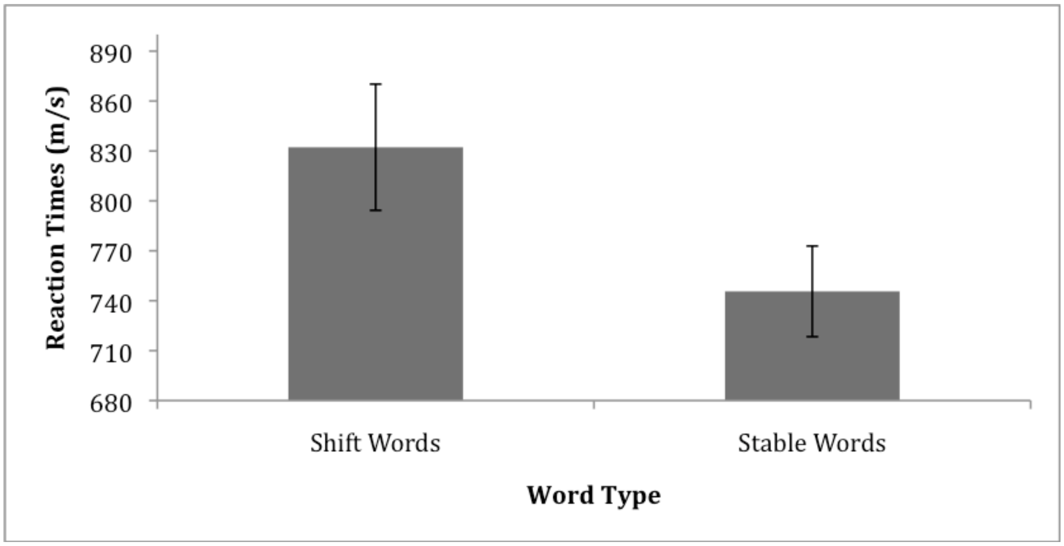


Figure 14

Average Reaction Times of Ing and Ing Matched Words

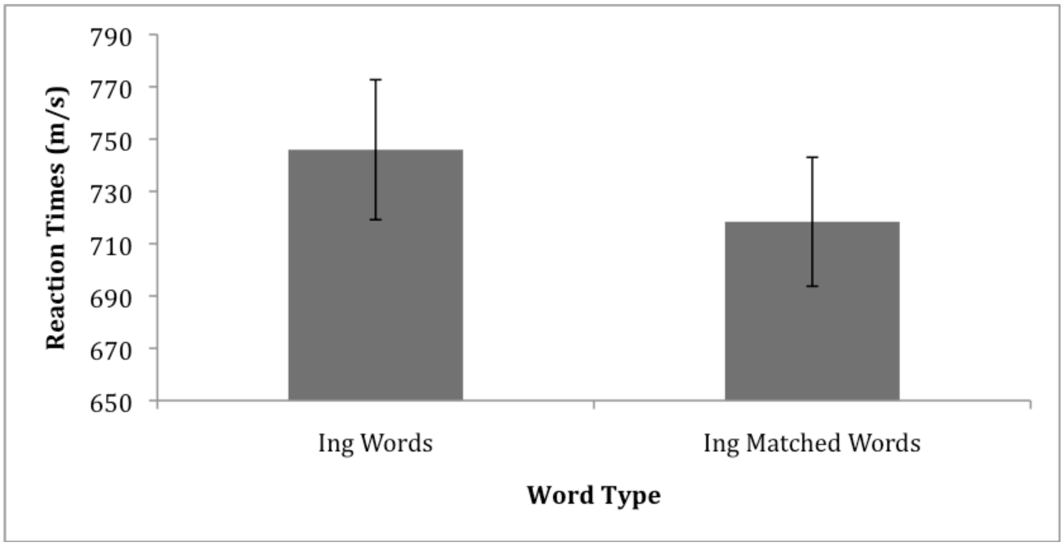


Figure 15

Average Reaction Times of Ed and Ed Matched Words

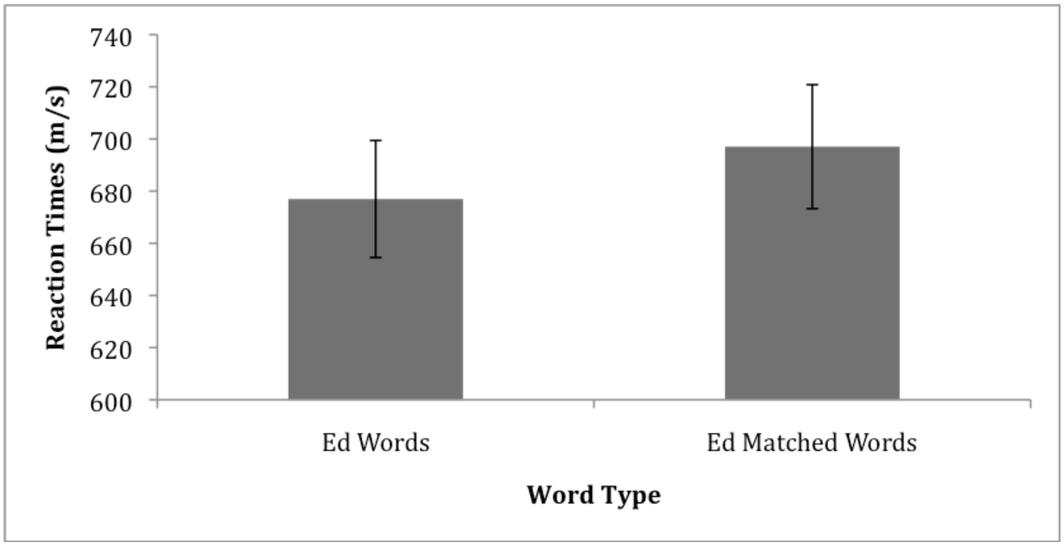
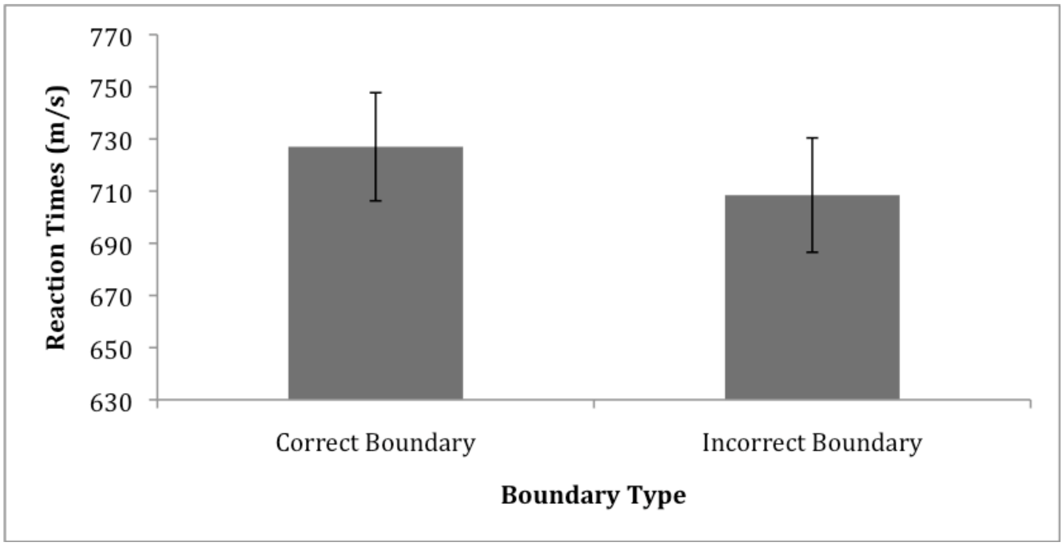


Figure 16

Average Reaction Times of Correct Boundary and Incorrect Boundary Words



DISCUSSION

The purpose of this study was to examine morphological skills and the relationship of these skills to reading abilities in low literate adults enrolled in Adult Basic Education courses. I was interested in assessing adults' accuracy and reaction times reading different types of morphologically complex words compared with control words in an oral reading passage as well as a single word recognition computer task. In addition to the passage and computer tasks, I administered a battery of literacy assessments designed to measure phonological, morphological, and general reading skills. The majority of the results provided support for my hypotheses regarding accuracy and reaction times on morphological complexity and task type. Participants were more accurate at reading control words as compared with morphologically complex words in both the oral reading passage and the computer task. Additionally, computer reaction times were faster on control words as compared with morphologically complex words. Moreover, words presented in context were processed more accurately than words presented in isolation. These findings suggest that low literate adults are sensitive to the morphological properties of words.

How accurate are low literate adults on different types of morphologically complex words compared with control words in an oral reading passage?

The first question posed in this study addressed accuracy on morphologically complex words compared with control words in an oral reading passage. Morphological complexity incorporated six word types: *-s*, *-ed, -ing*, morphologically complex (high frequency), low frequency with high frequency base, and phonological shift words and the matched control words included single morpheme *–s, -ed,* and *-ing*, pseudo complex, and stable words. I hypothesized that participants would demonstrate greater accuracy on all six of the matched control word types. Results indicated that in general low literate adults were more accurate on control words versus morphologically complex words including *–s* matched, *-ed* matched, pseudo complex, and stable words. The *–ing* word type and the high frequency base word type were the only ones not supported by my hypothesis: *-ing* control words were read as accurately *–ing* words and high frequency base matched controls were read as accurately as low frequency, high frequency base words.

Past literature reports that frequency, familiarity, and transparency of words play an important role in determining a reader's awareness of morphological structure. Researchers Carlisle and Stone (2005) found that derived words that are phonologically transparent and high frequency were read much more accurately than phonological shift and low frequency words for children. These findings are partially consistent with this study for adults: stable words were processed more accurately than phonological shift words. However; in terms of frequency, low frequency words with high frequency bases were read as accurately as the matched high frequency words with high frequency bases. Additionally, Carlisle and Stone found that high frequency words were read more accurately than the pseudo complex words. The adults were the exact opposite:

the pseudo complex words were read with more accuracy as compared with the high frequency words.

For both of these findings, I propose that adults possess the ability to engage in morphological decomposition – breaking a word down into its constituent morphemes – as opposed to processing words holistically. Thus, low literate adults recognized the high frequency base in the morphologically complex word forms but have less developed morphological awareness to efficiently process and accurately identify the derived form as compared with the pseudo complex, single morpheme words. I think the low frequency words with high frequency bases were read no differently as compared with high frequency words with high frequency bases as a result of contextual cues embedded in the passage as opposed to merely utilizing the base word to process the derived complex form. Additionally, frequency differences between adult and child frequency indexes may have accounted for the contradictory finding from the Carlisle and Stone (2005) child study.

The study expanded on much of the previous research on morphological errors with children (Smith-Lock, 1991; Walker & Hauerwas, 2006) by studying low literate adults and including inflected as well as derived words. Although the preponderance of morphological awareness research has been conducted with children, I predicted that similar trends would emerge with adults. Past research with children suggests that inflectional morphology begins to develop as early as preschool and knowledge of derivational morphology doesn't emerge until elementary school and increases as a function of age and grade (Anglin, 1993; Clark, 1982; Wysocki & Jenkins, 1987). Few child studies have incorporated words with inflected endings because knowledge of inflectional morphology begins early in the child's developmental trajectory of learning to read and is mastered by the early elementary school years.

Researchers Worthy and Viise (1996) compared adults in literacy classes with children matched on achievement level for spelling and reported that adults had particular difficulties with inflectional endings. Based on this research and my results from Experiment 1, I expected slight deviations from the children's research: I proposed that inflectional morphology presents more of a challenge for the low literate adult population. Experiment 1 indicated that low literate adults produced as many errors on inflected as compared with derived morphologically complex words. My results from Experiment 2 also demonstrated this trend: adults were less accurate on *–s* and *–ed* inflectional endings as compared with the control words.

Adults performed the same for *–ing* inflected endings as compared with single morpheme controls. Both the *–s* and *–ed* inflected endings have three phonological forms (*/-s/*, */-z/*, */-əz/* and */-əd/*, */-d/*, */-t/*, respectively) whereas the *–ing* inflected ending has only one form. Past research has indicated that children make more errors of omission in writing on *–s* and *–ed* endings as compared with *–ing* words because children need more developed morphological knowledge in order to apply the proper ending (Smith-Lock, 1991). Worthy and Viise (1996) observed that adults in literacy classes made many errors on inflectional endings during spelling – omissions and substituting words not semantically related to the target word. Moreover, the English language has many irregular word forms especially for transforming words to the past tense (*run* to *ran*). Thus, it makes sense that low literate adults learning the rules of the English language would experience greater difficulty on *–s* and *–ed* word endings as compared with *–ing* endings.

How accurate are low literate adults on different types of morphologically complex words compared with control words in a single word recognition computer task?

To address question two, the same word types were utilized in both the oral reading passage and the single word recognition task to maintain consistency between tasks. I hypothesized that low literate adults would be more accurate on control words as compared with morphologically complex words for all six word types. Results supported my hypothesis: adults were significantly more accurate on control words versus morphologically complex words for all six word types. Previous research with elementary children was consistent with these results: younger children were less accurate recognizing morphologically complex words as compared single morpheme words in isolation. With increasing age and grade, children's improved morphological skills correspond to automatic word recognition skills – with little to no discrepancy in accuracy between morphologically complex and single morpheme words. Since low literate adults have less developed morphological awareness, they are less accurate and slower in recognizing morphologically complex words. Leong (2000) administered computerized word-naming tasks to learning-disabled college students and found that this group recognized phonologically transparent words more accurately as compared with phonological shift words. This finding is consistent with the low literate adults in this study.

How do reaction times compare across frequency and transparency measures in a computer task?

Reaction times were collected for the two computer tasks. For computer Task 1, I hypothesized that adults would be faster at identifying control words as compared with morphologically complex words for all word types. Results revealed that four of the six word types followed this trend: -*s* matched, pseudo complex, high frequency base matched words, and stable words were recognized faster than –*s*, morphologically complex, low frequency, and phonological shift words. Altering frequency and transparency measures has been found to influence speed and accuracy of word identification in elementary and middle school children (Carlisle & Stone, 2005). Low literate adults were consistent with children's developmental trajectory, displaying sensitivity to differences in frequency and transparency – high frequency were processed faster than low frequency as well as phonological shift and stable words.

Two word types, -*ed* and –*ing* inflected endings, did not follow the same pattern. These word types were identified at the same rate as their subsequent matched controls. No research has been conducted on single word identification with inflected morphemes. Similar to my prediction regarding accuracy, I think since *–ing* has only one phonetic form it is easier to recognize and pronounce.

The *–ed* form presents a surprising finding because I would expect performance on *–ed* to match that of *–s* words since both have three phonetic forms. I speculate that alternative conclusions to explain this finding would include: 1. Although control words were matched based on frequency, the *–s* matched words were more familiar to the adults as compared with the *–ed* matched words; 2. The *–s* words were less common than the *–ed* words since words were not matched on frequency across inflected word types (*-s*, *-ed,* and *–ing*); and 3. The *–s* words were harder to identify because I utilized different phonetic forms (*eyes* represents the challenging */-z/* sound while *minutes* represents the */-s/* sound) whereas the *–ed* words were all pronounced with the more common */d/* or /*-əd*/ sounds and none represented the more challenging */t*/ sound. I think it is difficult to interpret this finding because I only included three words for each type of inflected ending and participants' accuracy scores matched my hypotheses: they performed better on the controls for all of these inflected word types.

How do reaction times compare when preserving versus disrupting morpheme boundaries?

Computer Task 2 assessed morpheme boundaries by presenting low literate adults with words adhering to proper boundaries (walkED) versus words disrupting morpheme boundaries (walKED) in a single word recognition task. Past research indicates that a disruption to the morpheme boundary presents reading challenges for skilled readers with higher levels of morphological awareness. Leong (1999) administered words adhering to and disrupting morpheme boundaries with three groups of college students: chronological age, reading age, and learning-disabled. He found that interrupting the morpheme boundary resulted in reading disruptions for the chronological age group but not for the reading age and learning-disabled groups. Performance for the reading age and learning-disabled groups was comparable for correct and incorrect morpheme boundaries, attributing to their lower levels of morphological awareness.

I hypothesized similar findings for low literate adults, since they have less developed morphological awareness reactions times and accuracy would be similar for words adhering to as well as disrupting the morpheme boundary. Additionally, Leong (1999) utilized learning-disabled college students and I predicted that some of the low literate adults would have even less morphological awareness and thus, may even show greater accuracy and faster reaction times on incorrect boundaries. Results demonstrated that on average participants were slightly, but not significantly, more accurate and faster at recognizing words disrupting the morpheme boundary. Thus, similar to the reading age and learning-disabled college students, low literate adults lack sensitivity and knowledge of the structure and rules of morphological boundaries.

Does context influence accuracy?

This study expanded on the Carlisle and Stone (2005) study by examining accuracy of word reading by looking at words presented in context versus words presented in isolation with low literate adults. It was important to examine the effect of morphemic structure on single word recognition versus reading words in context in which exposure to the interactive nature of spellings, pronunciations, and meanings present in a passage could influence accuracy and speed in word recognition. I expected that context would be a positive factor for word identification because context provides clues to infer meaning and thus, recognition of unfamiliar words.

With age, adults have more exposure to language and printed materials as compared with children. Low literate adults are no exception – this group typically has a more extensive oral vocabulary compared with children matched on achievement level. Low literate adults may know a word orally but not be able to identify the written form of that word. Thus, context and figuring out word meanings can play an especially important role for low literate adults. Results supported this hypothesis: adults were more accurate at identifying morphologically complex words in context. This finding was especially salient for phonological shift words: for words presented isolation only 34 participants got at least one word correct and of those averaged 36.5% accuracy whereas all 55 participants were included and averaged a 79.2% accuracy level for words in context. Consistent with research on children, contextual cues are beneficial for low literate adults.

Predictors of Reading Comprehension

A main focus of this study was to assess how morphological awareness, phonological awareness, and a general reading measure - Letter Word Identification – predict reading comprehension skills. Morphological, phonological, vocabulary, spelling, and general reading abilities – fluency and comprehension – have all been found to be important components to children's literacy acquisition (Anglin, 1993; Carlisle, 2000; Carlisle, 2003). Furthermore, morphological awareness has been found to play a significant role in reading comprehension, vocabulary growth, spelling abilities, and word recognition for both children and adults (Deacon & Kirby, 2004; Leong, 1999; Nagy et al., 1989). I hypothesized that as a set morphological, phonological, and general recognition of letters and words would predict reading comprehension skills. An overall significant regression model revealed that phonological awareness and morphological awareness predicted reading comprehension. Thus, consistent on children's reading research, morphology and phonology are important to literacy acquisition with low literate adults.

Previous literature on phonology and morphology has contested the degree to which phonological awareness and morphological awareness are separate, individual predictors of reading abilities. Until recently, phonological awareness was thought of as the single most important predictor of reading achievement in children (Carlisle, 2003). Recent research has addressed the interactive nature of phonological, orthographic, and morphological skills in reading development (Carlisle, 2003; Fowler, Liberman, 1995). Previous research with children indicates that phonological awareness and morphological awareness are correlated however; these are still separate literacy skills. After controlling for phonological and orthographic abilities, morphological awareness emerged as an important predictor of single word reading, word decoding, reading comprehension, and pseudoword reading for elementary school children (Deacon & Kirby, 2004).

Based on the controversial literature on children, I wanted to investigate morphological awareness independent of phonological awareness as a predictor for adult's reading comprehension abilities. I predicted that after controlling for phonological awareness, morphological awareness would be a unique predictor of reading comprehension skills. A hierarchical regression revealed that the proportion of variance accounted for significantly increased with the inclusion of morphological awareness as a predictor. The educational implications of this finding by increasing instruction of morphological rules in adult basic education programs are discussed later in the *Implications* sub-section of the Discussion.

Limitations

Although the results of this study provided support for almost all of the hypotheses, there were still a few limitations that should be addressed. First, the diversity and the size of the sample: the 57 participants spanned an array of ages, races, and class levels. Most importantly, the three different class levels (ESOL, pre-GED, and GED) can be tied to variations in ability levels. The study did not yield enough power to be able to break the participants down by class: only 11 ESOL, 12 Pre-GED, and 29 GED completed all tasks.

Second, there were several difficulties with the single word recognition computer task. Many of the word types included only 3 words whereas the oral reading passage had at least 6 words for each word type. By including only three words, especially for the inflected forms, there was little room for errors – if all words were missed an entire participant was eliminated from analyses. Additionally, since reaction times were averages and scores above two standard deviations were removed some participants had no reaction times for certain word types or reaction times based on only one word. This was especially problematic for the *–s* control words – *speed, shame,* and *soon* – which were the most common computer malfunction errors. Finally, the E-Prime software utilized to measure reaction times recorded the on-set time. This resulted in slightly inaccurate reaction times because stuttering and self-correcting was not taken into account.

Future Research

There are several important directions to consider for future research on morphological awareness and reading abilities in low literate adults. It would be interesting to differentiate by ability levels and investigate morphological skills from low literate adults beginning literacy programs through those in GED level classes. Age and ethnic background in relation to morphological awareness could also yield valuable information.

Comparing low literate adults matched with achievement level children could assess differences in the developmental trajectory of morphological, phonological, and general reading abilities. Experiment 1 of this study found differences from literature on children in that low literate adults struggle on inflected word forms as much as derived forms. Few studies have included inflected and derived morphemes and none assessing both children and adults. This type of study could have important implications for the most effective approaches to teaching adults morphological skills to apply to reading.

The present study mainly addressed reading abilities by looking at reading comprehension skills. It would be beneficial to include other reading abilities: fluency, vocabulary expansion, and spelling. Past research with children identifies morphological awareness as vital to these reading skills (Anglin, 1993; Deacon & Kirby, 2004). The ability of low literate adults to utilize morphologically complex words in their writing as well as common morphological error types in writing would be another interesting area to further investigate. Fluent speech requires an understanding of morphological rules and writing is even more cognitively demanding than oral language and therefore, requires an even greater degree of knowledge of word structure and morphemes. Low literate adults have more exposure to spoken language as compared with children; however, research indicates that oral morphological skills do not translate to written abilities. Furthermore, Rubin et al. (1991) found that maturation and increased exposure to print had no effect on low literate adults' abilities to employ morphological rules in writing. In fact, when compared with second graders, the adults produced significantly more written morphological errors.

Finally, future studies could utilize similar manipulations of morphological complexity to the present study; however, utilizing eye-tracking in children and low literate adults. It would be important to assess fixation duration on inflected and derived morphologically complex words by altering morphological types: frequency of words and root words, word family size, pseudo-words, and transparency measures. Based on the results of the current study, low literate adults were significantly more accurate and faster at identifying pseudo-complex as compared with morphologically complex words. This is a contradiction to the children literature in which children processed morphologically complex words more accurately than pseudo-complex words based on the assumption that children parse complex words into separate morphemes (Carlisle & Stone, 2005). This line of research could address this issue by assessing word recognition models for adults: direct access (retrieving words as wholes) versus morphological decomposition (splitting words into distinct morphemes). Moreover, this might have important implications for differences in the most effective instructional approaches for adult as compared with children.

Educational Implications

Although the English language is morphophonemic in nature, the preponderance of research and interventions has focused solely on teaching children about phoneme-grapheme correspondences. By emphasizing phonology, the link between sounds and letters, the parallel connection between letters and morphemes is not typically explicitly taught in the classroom (Nunes & Bryant, 2009). Recent research has found that morphological knowledge is important in many areas of reading development – fluency, comprehension, and vocabulary growth (Anglin, 1993; Deacon & Kirby, 2004). Furthermore, Nagy and Anderson (1984) postulated that as children progress through school they encounter an increasingly greater number of morphologically complex words and that an underlying knowledge of word structure can have significant effects on the speed of word processing and acquisition of new words. Despite the findings regarding the importance of morphological skills to reading abilities, morphology is seldom included in literacy instruction (Nunes & Bryant, 2009).

The results of the current study indicated that low literate adults are sensitive to morphological complexity and would likely benefit from explicit morphological instruction. Understanding morphemic structure aids children in understanding and figuring out unfamiliar words and directly corresponds to spelling. The importance of rules regarding morphology and spelling contradicts some of the phoneme-grapheme correspondences when alternative pronunciations exist for word endings that are spelled the same way. For example, the past tense inflection, *-ed*, presents a challenge because *kissed* (*/t/* sound), *killed* (*/d/* sound), and *waited* (*/-əd/* sound) are all spelled the same, but pronounced differently – a contradiction of phoneme-grapheme rules (Carlisle, 2010). Nunes and Bryant (2009) proposed a reading program emphasizing spelling abilities by directly teaching morphemic spelling rules. This type of instruction allows learners to focus more on word structure – learning prefixes and suffixes – and apply these rules to promote reading comprehension and expand vocabulary.

I think this type of instruction would be beneficial for low literate adults because they struggle with inflected endings. Research has found that this group suffers from poor understanding of morphological structure and under-developed phonological skills; however, they have better orthographic knowledge in comparison with children matched on achievement level (Smith-Lock, 1991; Worthy & Viise, 1996). Thus, instead of solely addressing phonology, direct instruction to develop connections between adults' current advanced orthographic skills and knowledge of morphological structure may help them infer meanings of novel words.

Preliminary research has found transfer effects of morphological skills across languages (Nunes & Bryant, 2009). Castro, Nunes, and Strecht-Ribeiro (2004) investigated morphological awareness in Portuguese children as a predictor of learning English as a second language. The researchers found that the children's morphological awareness in their primary language predicted their abilities to learn vocabulary and word reading in a second language. Similar findings have been found in native Hebrew and French speakers (Nunes & Bryant, 2009). Morphology is considered one of the most difficult aspects when learning to read in a second language and therefore, I think these findings could have important educational implications for the ESOL adults in the current study. The ESOL students may benefit from including the explicit teaching of morphological rules and structure of words to improve their morphological awareness and subsequently vocabulary and reading comprehension skills. Additionally, many of the ESOL adults in this study are native Spanish speakers and therefore teaching them about cognates may also aid in acquiring proficiency in the English language.

Explicit teaching of morphology is important, but literacy instruction cannot entirely eliminate the teaching of phonology. Instead, research on children who are poor readers indicates the need for instruction which combines both phonological and morphological skills. Previously, poor readers were taught almost exclusively to improve their awareness of phonemes however; these interventions have proven only moderately successful (Nunes & Bryant, 2009). One study assigned poor readers to three groups: phonological training, morphological training, and a control group. Results indicated that knowledge of morphological skills was important to improving reading abilities; however, morphological instruction alone did not compensate for phonological difficulties (Nunes & Bryant, 2009). Thus, an integrated intervention in phonological and morphological skills is important for poor readers.

Since low literate adults were effective in employing morphological knowledge and utilizing contextual information to identify words, instruction in morphemic and contextual analysis skills may be beneficial. Baumann, Edwards, Font, Tereshinski, Kame'enui, and Olejnik (2002) studied the effects of four interventions: morphemic-only, context-only, combined morphemic-context, and an instructed control group on vocabulary learning and reading comprehension with fifth-graders. After a series of instructional sessions, students were tested on their abilities to infer meanings of unfamiliar words, which contained morphemic elements or were embedded in text along with contextual clues. Results revealed that taught knowledge of morphemic elements as well as taught contextual analysis strategies aided students in indentifying untaught words. The effect of combined instruction in morphemic and contextual analysis did not differ as compared with the morphemic-only and context-only groups. I think instruction in both morphemic and contextual analysis should be investigated with adults in literacy programs.

In sum, an integrative instructional approach encompassing phonological, morphological, orthographic, and contextual analysis should be explored in adult literacy programs. I think switching from strictly focusing on phonological abilities to emphasizing more knowledge of morphemes and underlying word structure will help adults identify base morphemes and be able to apply this knowledge to infer more advanced unfamiliar morphologically complex words. Finally, I think it is important to recognize that the most effective instruction may be different for children and adults learning to read. Whereas children are not fluent in spoken language, emphasizing letter-sound correspondences may be really important whereas adults are fluent in spoken language and have more exposure to print and thus may benefit more from improving their knowledge of morphemic spelling rules.

REFERENCES

Adams, M.J. (1990). *Beginning to read: Thinking and learning about print*. Cambridge, MA: MIT Press.

Anglin, J.M. (1993). Vocabulary development: A morphological analysis. *Monographs of the Society for Research in Child Development, 58*(10), v-165.

August, D., Carlo, M., Dressler, C., & Snow, C.E. (2005). The critical role of vocabulary development for English language learners. *Learning Disabilities: Research and Practice, 20,* 50-57.

Baer, J., Kutner, M., & Sabatini, J. (2009). *Basic reading skills and the literacy of America's least literate adults: Results from the 2003 National Assessment of Adult Literacy (NAAL) supplemental studies* (NCES 2009-481). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington D.C.

Bailet, L.L., & Lyon, G.R. (1986). Deficient linguistic rule application in an LD speller: A case study. *Journal of Learning Disabilities, 18,* 162-165.

Baumann, J.F., Edwards, E.C., Font, G., Tereshinski, C.A., Kame'enui, E.J., & Olejnik, S.F. (2002). Teaching morphemic and contextual analysis to fifth-grade students. *Reading Research Quarterly, 37,* 150-176.

Berko, J. (1958). The child's learning of English morphology. *Word*, *14,* 150-177.

Berninger, V., & Nagy, W. (1999). *University of Washington Morphological Awareness Battery.* Unpublished experimental test battery, Seattle, WA.

Brittain, M. (1970). Inflectional performance and early reading achievement. *Reading Research Quarterly, 6,* 34-38.

Brown, R. (1973). *A first language: The early stages.* Cambridge, MA: Harvard University Press.

Carlisle, J.F. (1988). Knowledge of derivational morphology and spelling ability in fourth, sixth, and eighth graders. *Applied Psycholinguistics, 9,* 247-266.

Carlisle, J.F. (1996). An exploratory study of morphological errors in children's written stories. *Reading and Writing: An Interdisciplinary Journal, 8,* 61-72.

Carlisle, J.F. (2000). Awareness of the structure and meaning of morphologically complex words: Impact on reading. *Reading and Writing: An Interdisciplinary Journal, 12,*169-190.

Carlisle, J.F. (2003). Morphology matters in learning to read: A commentary. *Reading Psychology, 24,* 291-322.

Carlisle, J.F., & Stone, C.A. (2005). Exploring the role of morphemes in word reading. *Reading Research Quarterly, 40,* 428-449.

Carlisle, J.F., & Katz, L.A. (2006). Effects of word and morpheme familiarity on reading of derived words. *Reading and Writing: An Interdisciplinary Journal, 19,* 669-693.

Carlisle, J.F. (2010). Review of Nunes, T., and Bryant, P. (2006). Improving literacy by teaching morphemes. London: Routledge. *Reading and Writing: An Interdisciplinary Journal, 23,* 257-262.

Carlo, M.S., August, D., McLaughlin, B., Snow, C.E., Dressler, C., Lippman, D.N., Lively, R.J., & White, C.E. (2004). Closing the gap: Addressing the vocabulary needs of English-language learners in bilingual and mainstream classrooms. *Reading Research Quarterly, 39,* 188-215.

Carroll, J.B., Davies, P., & Richman, B. (1971). *Word frequency book.* New York: American Heritage Publishing Co., Inc.

Castro, A., Nunes, T., & Strecht-Riberio, O. (2004). Relação entre consciência gramatical na linguagem materna e progresso na aprendizagem de uma lingua estrangeira. In T. Nunes & P. Bryant, *Children's reading and spelling: beyond the first steps* (pp. 200-207). West Sussex, UK: Wiley-Blackwell.

Clark, E.V. (1982). The young word maker: A case study of innovations in the child's lexicon. In E. Wanner & L. Gleitman (Eds.), *Language acquisition: The state of the art* (pp. 390-425). New York: Cambridge University Press.

Clark, E.V., & Berman, R.A. (1987). Types of linguistic knowledge: Interpreting and producing compound nouns. *Journal of Child Language, 14,* 547-567.

Clark, E.V., & Hecht, B.F. (1982). Learning to coin agent and instrument nouns. *Cognition, 12,* 1-24.

Deacon, S.H., & Kirby, J.R. (2004). Morphological awareness: Just "more phonological"? The roles of morphological and phonological awareness in reading development. *Applied Psycholinguistics, 25,* 223-238.

Derwing, B.L., & Baker, W.J. (1979). Recent research on the acquisition of English morphology. In P. Fletcher & M. Garman (Eds.), *Language acquisition: Studies in first language development* (pp. 209-223). New York: Cambridge University Press.

Derwing, B.L., & Baker , W.J. (1986). Assessing morphological development. In P. Fletcher & M. Garman (Eds), *Language acquisition: Studies in first language development* (2nd Edition, pp. 326-338). New York: Cambridge University Press.

Egan, J., & Pring, L. (2004). The processing of inflectional morphology: A comparison of children with and without dyslexia. *Reading and Writing: An Interdisciplinary Journal, 17,* 567-591.

Fowler, A.E., & Liberman, I.Y. (1995). The role of phonology and orthography in morphological awareness. In Feldman, LL.B. (ed.), *Morphological aspects of language processing* (pp. 157-188). Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Freyd, P., & Baron, J. (1982). Individual differences in acquisition of derivational morphology. *Journal of Verbal Learning and Verbal Behavior, 21,* 282-295.

Good, R. H., Gruba, J., & Kaminski, R.A. (2001). Best practices in using Dynamic Indicators of Basic Literacy Skills (DIBELS) in an outcome-driven model. *Best Practices in School Psychology IV*, 679-700.

Good, R. H., & Kaminski, R. A. (Eds.). (2002). *Dynamic Indicators of Basic Early Literacy Skills (6th ed.).* Eugene, OR: Institute for the Development of Educational Achievement. Available: http://dibels.uoregon.edu/.

Hancin-Bhatt, B., & Nagy, W. (1994). Lexical transfer and second language morphological development. *Applied Psycholinguistics, 15,* 289-310.

Jarmulowicz, L., Hay, S.E., Taran, V.L., & Ethington, C.A. (2008). Fitting derivational morphophonology into a developmental model of reading. *Reading and Writing: An Interdisciplinary Journal, 21,* 275-297.

Kieffer, M.J., & Lesaux, N.K. (2008). The role of derivational morphology in the reading comprehension of Spanish-speaking English language learners. *Reading and Writing: An Interdisciplinary Journal, 21,* 783-804.

Kirsch, I. S., Jungeblut, A., Jenkins, L., & Kolstad, A. (1993). *Adult literacy in America: A first look at the results of the National Adult Literacy Survey*. (NCES 93-275). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington D.C.

Kutner, M., Greenberg, E., & Baer, J. (2005). *A first look at the literacy of America's adults in the 21st century.* (NCES 2006-477) National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington D.C.

Kutner, M., Greenberg, E., Jin, Y., Boyle, B., Hsu, Y. & Dunleavy, E. (2007). *Literacy in Everyday Life: Results From the 2003 National Assessment of Adult Literacy*. (NCES 2007–480). National Center for Education Statistics, U.S. Department of Education. Washington D.C.

Larsen, J.A., & Nippold, M.A. (2007). Morphological analysis in school-age children: Dynamic assessment of a word learning strategy. *Language, Speech, and Hearing Services in Schools, 38,* 201-212.

Leong, C.K., & Parkinson, M.E. (1992). Sensitivity to orthotactic rules in visual word recognition by below average readers. *Reading and Writing: An Interdisciplinary Journal, 4,* 1-17.

Leong, C.K. (1999). Phonological and morphological processing in adult students with learning/reading disabilities. *Journal of Learning Disabilities, 32*, 224-238.

Leong, C.K. (2000). Rapid processing of base and derived forms of words and grades 4, 5, and 6 children's spelling. *Reading and Writing: An Interdisciplinary Journal, 12,* 277-302.

Liberman, I.Y., Rubin, H., Duques, S., & Carlisle, J. (1985). Linguistic abilities and spelling proficiency in kindergarteners and adult poor spellers. In D.B. Gray & J.F. Kavanagh (Eds.), *Biobehavioral measures of dyslexia* (pp. 163-176). Parkton, MD: York Press.

Mahony, D.L. (1994). Using sensitivity to word structure to explain variance in high school and college level reading ability. *Reading and Writing: An Interdisciplinary Journal, 6,* 19-44.

Marcus, G.F., Pinker, S., Ullman, M., Hollander, M., Rosen, T.J., & Xu, F. (1992). Overregulation in language acquisition. *Monographs of the Society for Research in Child Development, 57*(4).

Nagy, W.E., & Anderson, R.C. (1984). The number of words in printed school English. *Reading Research Quarterly, 19,* 304-330.

Nagy, W.E., Anderson, R., Schommer, M., Scott, J.A., & Stallman, A.C. (1989). Morphological families and word recognition. *Reading Research Quarterly, 24,* 262-282.

Nagy, W., Berninger, V.W., & Abbott, R.D. (2006). Contribution of morphology beyond phonology to literacy outcomes of upper elementary and middle-school students. *Journal of Educational Psychology, 98*(1), 134-147.

Nagy, W., Diakidoy, I., & Anderson, R. (1993). The acquisition of morphology: Learning the contribution of suffixes to the meaning of derivatives. *Journal of Reading Behavior, 25,* 155-170.

Nagy, W., & Herman, P. (1987). Depth and breadth of vocabulary knowledge: Implications for acquisition and instruction. In M.G. McKeown & M.E. Curtis (Eds.), *The nature of vocabulary acquisition.* (pp. 19-35). Hillsdale, NJ: Lawrence Erlbaum Associates.

Nagy, W.E., Herman, P.A., & Anderson, R.C. (1985). Learning words from context. *Reading Research Quarterly, 20,* 233-253.

Nunes, T., Bryant, P., & Bindman, M. (1996). The effects of learning to spell on children's awareness of morphology. *Reading and Writing, 19,* 767-787.

Nunes, T., Bryant, P., & Bindman, M. (1997). Morphological spelling strategies: Developmental stages and processes. *Developmental Psychology, 33*(4), 637-649.

Nunes, T., & Bryant, P. (2009). *Children's reading and spelling: Beyond the first steps.* West Sussex, UK: Wiley-Blackwell.

Odlin, T. (1989). *Language transfer: Cross-linguistic influences in language learning.* New York: Cambridge University Press.

Raveh, M., & Schiff, R. (2008). Visual and auditory morphological priming in adults with developmental dyslexia. *Scientific Studies of Reading, 12,* 221-252.

Reichle, E.D., & Perfetti, C.A. (2003). Morphology in word identification: A word experience model that accounts for morpheme frequency effects. *Scientific Studies of Reading, 7,* 219-237.

Rouse, H.L., & Fantuzzo J.W. (2006). Validity of the Dynamic Indicators for Basic Early Literacy Skills as an indicator of early literacy for urban kindergarten children. *School Psychology Review*, 35(3), 341-355.

Rubin, H., Patterson, P.A., & Kantor, M. (1991). Morphological development and writing ability in children and adults. *Language, Speech, and Hearing Services in Schools, 22,* 228-235.

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

Smith-Lock, K.M. (1991). Errors of inflection in the writing of normal and poor readers. *Language and Speech, 34,* 341-350.

Sternberg, R.J. (1987). Most vocabulary is learned from context. In M.G. McKeown & M.E. Curtis (Eds.), *The nature of vocabulary acquisition.* (pp. 89-106). Hillsdale, NJ: Lawrence Erlbaum Associates.

Viise, N.M. (1992). A comparison of child and adult spelling development. Unpublished doctoral dissertation. Charlottesville, VA: University of Virginia.

Walker, J., & Hauerwas, L.B. (2006). Development of phonological, morphological, and orthographic knowledge in young spellers: The case of inflected verbs. *Reading and Writing: An Interdisciplinary Journal, 19,* 819-843.

Worthy, J., & Viise, N.M. (1996). Morphological, phonological, and orthographic differences between the spelling of normally achieving children and basic literacy adults. *Reading and Writing: An Interdisciplinary Journal, 8,* 139-159.

Woodcock, R.W. (1987). *Woodcock Mastery Reading Tests – Revised*. Circle Pines, MN: AGS Publishing.

Wysocki, K., & Jenkins, J.R. (1987). Deriving word meanings through morphological generalization. *Reading Research Quarterly, 22*(1), 66-81.

Appendix A

DIBELS Oral Reading Fluency (Benchmark 1.1)

My Friend

I have a new friend at school. She can't walk so she uses a 14
wheelchair to get around. She comes to school in a special van 26
that can transport four people who use wheelchairs. The van 36
brings my friend and another boy to school. My friend is in third 49
grade with me and the boy is a fourth grader. 59

I like to watch my friend get in and out of the van. The driver 74
pushes a button and part of the van floor lowers to the driveway 87
to form a ramp. My friend just wheels up the ramp and goes 100
inside. When she is inside, the driver pushes the button and the 112
ramp puts itself away. When it is time to get out of the van, they 127
do the same thing again. Sometimes I help open the door so she 140
can roll right inside. 144

My friend and I do everything together. Our teacher lets us 155
sit together in the front row, and we always go to lunch together. 168
My friend moves so fast down the hall that she always gets the 181
best seats in the cafeteria. Sometimes we trade sandwiches. At 191
recess, we always play on the same team. My friend sure has 203
strong arms. She hardly ever misses a shot when we play 214
basketball and she can throw the farthest of anyone in third grade. 226

Appendix B

MOUNT HOLYOKE COLLEGE
INFORMED CONSENT FORM

Title of Study: Analysis of Morphological Errors and Rates of Word Recognition for Adults Participating in Adult Basic Education Programs
Investigator(s): Elizabeth Tighe and supervised by Kathy Binder, a professor in the Psychology and Education department at Mount Holyoke College.

Brief description of project and procedures to be followed: The purpose of the project is to study understand how individuals recognize words when presented in the context of a story versus words presented individually. This study will involve two thirty-minute sessions, which will take place over two days. You will be required to read a passage, read single words presented on a computer screen, as well as tests to fill in blanks with missing words, recognize single letters and words, and sound out real and fake words. While you complete all of these tasks, I will tape record you.

This project has been approved by the Institutional Review Board of Mount Holyoke College.

You understand that:

A. Your participation is voluntary.

B. You must be over age 18 in order to participate in the study.

C. You may withdraw my consent and discontinue participation in this study at any time. You will not be penalized in any way if you decide not to participate.

D. I will explain the procedures to be followed in the project to you, and I will answer any questions you may have about the aims or methods of the project will be answered.

E. All of the information from this study will be treated as strictly confidential. No names will be associated with the data in any way. If you provide your address in order to receive a report of this research upon its completion, that information will not be used to identify you in the data. The data will be stored in locked offices in the Reese Psychology and Education department at Mount Holyoke College and the data will be accessible only to the investigators.

F. You will be audio recorded during all tasks. The tape will be deleted as soon as the material is transcribed.

G. The results of this study will be made part of a final research report and may be used in papers submitted for publication or presented at professional conferences, but under no circumstances will your name or other identifying characteristics be included.

If you understand the above, and consent to participate in the project, please sign here:

____ (Participant sign here)

____ (Participant print name here)

____ (Date)

If you have any questions about this research, contact Elizabeth Tighe (the investigator) at tighe20e@mtholyoke.edu (413-896-1719) or Kathy Binder (research supervisor) at kbinder@mtholyoke.edu, or Mount Holyoke College's Institutional Review Board, at institutional-review-board@mtholyoke.edu.

Would you like a report on the results of this research project upon its completion?

YES NO

Address to which the report should be sent: _________________________________

Appendix C

Oral Reading Passage
(Bold words are those from the Carlisle and Stone (2005) study)

Long before **colonial** times, in the **hilly** region of France, there was a **silly** young prince in search of a **lover**. All his wealth did not make a **difference** because he was very lonely in his large, **empty** palace. He wanted a **lady** to cook him **dinner** and clean his **dirty** home. He needed to add **flavor** to his **cookery** and style to his dull house. But first he had to make a **confession -** before he was a prince, he was a **beggar** and a **thief.** He entered the lottery and became a **winner.** Despite his financial **security**, he was afraid and **secretive.** It was a **fearsome** worry that someone would discover his past.

One day a **pretty** woman wearing a **stylish** dress with a **flowery** design walked by the castle. She was singing a beautiful melody. He looked at her with **intensity** and liked her **sparkly** earrings and blond hair. He was drawn to her **natural** beauty. He went up to her with **confidence** and invited her to the annual music **convention.** Realizing his **sincerity** and charming good looks, she said yes. They sat on the grass beneath a **shady** tree to enjoy the **serenity** of the afternoon and discuss their mutual **preference** for **classical** music. He took her to the opera and the ballet.

The prince could not stop smiling because he felt so **lucky.** The couple began spending every moment together. The prince's friends took his **dependence** on her for **stupidity** and lack of **maturity.** He was hurt by the **severity** of their opinions. But he did **hover** and cling to her the **majority** of the time. He gave her a hundred presents and asked her to marry him. She explained her **cultural** beliefs – since she was the youngest daughter, she had to stay home and take care of her mother. He looked at her in **puzzlement** and his heart broke to pieces. He was alone again, still in search of his princess.

Appendix D

Word Recognition Tasks

Task 1 Word List:

Inflectional Words (*-s, -ing,* and *–ed*) Matched for Frequency

Eyes	Soon
Minutes	Speed
Tastes	Shame
Falling	Volume
Swirling	Senior
Enjoying	Garbage
Worked	Pattern
Noted	Sink
Colored	Bottle

High Frequency Complex Words Matched with Pseudo Complex Derived Words

Icy	Mercy
Windy	Candy
Batter	Chapter
Robber	Rubber
Mower	Tower

Low Frequency Derived Words, with High Frequency Bases

Pailful

Beastly

Queendom

Idealize

Corrective

Odorous

Stable and Phonological Shift Words

Confusion	Precision
Conformity	Finality
Activity	Mortality
Oddity	Locality

Task 2: Morpheme Boundaries Word List:

List 1	List 2
reTURN	retURN
TEACher	TEACHer
LEADer	LEAder
DICtionary	DICTIONary
COMFORTable	COMFORtable
NATional	NATIONal
aWAKE	awAKE
remAIN	reMAIN

ATTRACTive	ATTRACtive
LOwest	LOWest

Appendix E

Tests of Morphological Awareness

Derived Form Morphology (DMorph) Task

Practice

a. Farm. My uncle is a _____. [Farmer]

b. Help. My sister is always _____. [Helpful]

No-Change Condition

1. Warm. He chose the jacket for its _____. [Warmth]

2. Teach. He was a very good _____. [Teacher]

3. Four. The cyclist came in _____. [Fourth]

4. Remark. The speed of the car was _____. [Remarkable]

5. Reason. Her argument was quite _____. [Reasonable]

6. Final. After trying many times he won the game_______. [Finally]

7. Assist. The teacher will give you _____. [Assistance]

Orthographic Change Condition

1. Adventure. The trip sounded _____. [Adventurous]

2. Glory. The view from the hilltop was _____. [Glorious]

3. Happy. Money does not buy _______. [Happiness]

4. Expense. The new car was _______. [Expensive]

5. Noise. The children were very ______. [Noisy]

6. Secure. An alarm system provides ______. [Security]

7. Rely. The babysitter was _______. [Reliable]

Phonological Change Condition

1. Human. The kind man was known for his _____. [Humanity]

2. Equal. Boys and girls are treated with ______. [Equality]

3. Major. He won the vote by a _____. [Majority]

4. Drama. The actress was very ______. [Dramatic]

5. Engine. He works as an ______. [Engineer]

6. Music. He is a talented _______. [Musician]

7. Heal. The mother was worried about her son's ______. [Health]

Both Change Condition

1. Deep. The lake was well known for its ______. [Depth]

2. Produce. The play was a grand _____. [Production]

3. Explain. His excuse was a bad _______. [Explanation]

4. Absorb. She chose the sponge for its _____. [Absorption]

5. Permit. Father refused to give _____. [Permission]

6. Long. They measured the ladder's _____. [Length]

7. Expand. The company planned an _____. [Expansion]

Base Form Morphology (BMorph) Task

Practice

a. Admission. How many people will they _____? [Admit]

b. Improvement. My teacher wants my spelling to _____. [Improve]

No-Change Condition

1. Growth. She wanted her plant to _____. [Grow]

2. Difference. Do their opinions _____? [Differ]

3. Dangerous. Are the children in any _____? [Danger]

4. Agreeable. With that statement I could not _____. [Agree]

5. Driver. Children are too young to _____. [Drive]

6. Dryer. Put the wash out to _____. [Dry]

7. Baker. She put the bread in to _____. [Bake]

Orthographic Change Condition

1. Runner. How fast can she _____? [Run]

2. Density. The smoke in the room was very _____. [Dense]

3. Continuous. How long will the storm _____? [Continue]

4. Variable. The time of his arrival did not _____. [Vary]

5. Guidance. The map was her _____. [Guide]

6. Reliable. On his friend he could always _____. [Rely]

7. Foggy. They could not see very far because of the heavy ______. [Fog]

Phonological Change Condition

1. Publicity. His views were made _____. [Public]

2. Popularity. The girl wants to be _____. [Popular]

3. Election. Which person did they _____? [Elect]

4. Originality. That painting is very _____. [Original]

5. Courageous. The man showed great _____. [Courage]

6. Exhibition. The class went to the dinosaur _______. [Exhibit]

7. Cleanliness. Make sure your room is ______. [Clean]

Both Change Condition

1. Width. The mouth of the river is very _____. [Wide]

2. Division. The cake is hard to _____. [Divide]

3. Athletic. The girl was a great ______. [Athlete]

4. Description. The picture is hard to _____. [Describe]

5. Fifth. The boy counted from one to _____. [Five]

6. Strength. The girl was very _____. [Strong]

7. Decision. The boy found it hard to _____. [Decide]

Derivational Suffix Choice Test of Pseudowords

1. Our teacher taught us how to __________ long words.
   a. jittling b. jittles c. jittled d. jittle

2. _________ makes me happy.
   a. blopness b. bloply c. blopish d. blopable

3. The _________ boy plays soccer.
   a. tweagness b. tweagish c. tweagment d. tweagtion

4. The girl dances ________.
   a. spridderish b. spriddered c. spridderly d. spridding

5. I could feel the _________.

a. froodly b. froodful c. frooden d. froodness

6. What a completely ________ idea.

a. tribacious b. tribicism c. tribacize d. tribation

7. I admire her ________.

a. sufilive b. sufilify c. sufilation d. sufilize

8. Where do they ________ the money?

a. curfamic b. curfamity c. curfamate d. curfamation

9. Please ________.

a. scriptial b. scriptize c. scriptist d. scriptious

10. The meeting was very _________.

a. lorialize b. lorial c. lorialism d. lorify

11. I just heard a ________ story.

a. dantment b. dantive c. danticism d. dandify

12. Dr. Smith is a famous ________.

a. cicarist b. cicarize c. cicarify d. cicarial

13. Can you ________ both sides?

a. romify b. romity c. romious d. romative

14. He has too much ________.

a. brinable b. brinicity c. brinify d. brinicious

Appendix F

Tests of Phonological Awareness

Word Attack Subtest of the Woodcock Reading Mastery Tests – Revised

Item 1:

Researcher: **“Look at these letters”** (Runs fingers across the four letters). **“Point to the letter that makes the /p/ sound in the word ‘pig’”.**

z p k r

Correct: Researcher points to p.

Error/No Response: Researcher points to p and says, “**This letter makes the /p/ sound as in the word ‘pig’. Now you point to the letter that makes the /p/ sound”.**

Item 2:

Researcher: **“What is the sound of this letter?”** Points to “k” on participant’s page.

If correct: Researcher says /k/ sound.

If participant says name of letter – **“That is the name of the letter. Tell me its sound”.**

Item 3:

Researcher: **“What is the sound of this letter?”** Points to “n” on participant’s page.

If correct: Researcher says /n/ sound.

If participant says name of letter – **“That is the name of the letter. Tell me its sound”.**

Move on to Practice Items A and B:

Researcher: **"I want you to read some words that are not real words. Tell me how they sound".** Points to "nat". **"How does this word sound?"**

Researcher: **"Read this word to me".** Points to "ib".

After completion of the practice words:

Researcher: "**Read each of these words to me. Don't go too fast."**

Remainder of Items on Word Attack:

tiff	yosh	lindify
nan	tayed	saist
rox	grawl	knoink
zoop	loast	whumb
lish	sluke	mafreatsun
dright	thrept	phigh
rox	wheeg	deprotenation
feap	mibgus	paraphonity
gusp	splaunch	coge
snirk	quantric	apertuate

DIBELS Phoneme Segmentation Fluency Subtest

Researcher: **"I am going to say a word. After I say it, you tell me all the sounds in the word. So, if I say, 'sam', you would say /s/ /a/ /m/. Let's try one. Tell me the sounds in 'mop'".**

If correct: **"Very good. The sounds in 'mop' are /m/ /o/ /p/".**

Incorrect: **"The sounds in 'mop' are /m/ /o/ /p/. Your turn. Tell me the sounds in 'mop'".**

Researcher: **Ok. Here is your first word.**

hat	/h/ /a/ /t/	hear	/h/ /e/ /a/ /r/	yell	/y/ /e/ /l/
as	/a/ /z/	punch	/p/ /u/ /n/ /ch/	ham	/h/ /a/ /m/
means	/m/ /ea/ /n/ /z/	by	/b/ /ie/	calls	/k/ /o/ /l/ /z/
seem	/s/ /ea/ /m/	ship	/sh/ /i/ /p/	ear	/ea/ /r/
ought	/o/ /t/	pack	/p/ /a/ /k/	key	/k/ /ea/
jam	/j/ /a/ /m/	if	/i/ /f/	crowd	/k/ /r/ /ow/ /d/
loud	/l/ /ow/ /d/	choose	/ch/ /oo/ /z/	bare	/b/ /ai/ /r/
bills	/b/ /i/ /l/ /z/	guy	/g/ /ie/	stand	/s/ /t/ /a/ /n/ /d/

Appendix G

Reading Ability Measures

Letter-Word Identification Subtest of the Woodcock Reading Mastery Tests – Revised

Item 1:

Researcher: Points to letter at the top of the subject's page and says, "**This is the letter 'P'.**" Runs hand across the four letters. "**Find the 'P' down here**".

P

O B

K P

Correct: Points to the "P".

Researcher: **"Here are some letters".** (Runs fingers across the letters on the page). **I want you to point to the letter I say. Point to the 'k'".**

i k r m u y

Correct Points to the "k".

Researcher: **"Point to the 'r'".**

Correct Points to the "r".

Item 2:

Researcher: Points to the letter "A" on the page and says, **"What is the name of this letter?"**

Correct: Says "A".

Item 3:

Researcher: Runs fingers across words on page and says **"Point to the word 'cat'".**

cat my on red

Correct: Points to "cat".

Item 4:

Researcher: Points to word on the page and says, **"What is this word?"** After participant responds, **"Go ahead with the others. Don't go too fast".**

Remainder of Words on the task, increasing in difficulty by column.

to	they	because	since
dog	when	knew	distance
in	there	own	usually
can	must	whole	scientist
as	about	against	bounties
get	only	sentence	fierce
was	part	island	experience
have	could	decide	moustache

Passage Comprehension Subtest of the Woodcock Reading Mastery Tests - Revised

Item 1:

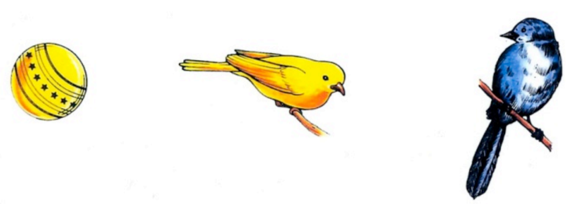
Researcher: Points to the rebus (symbol, not picture) for "house" and says, **"This is 'house'".** Points to the rebus for "dog" and says, **"This is 'dog'".**

"Now can you show me which one of these (points to the two rebuses) **tells us about this big picture** (points to picture of the house).

Correct: Points to the rebus for "house".

Item 2:

Researcher: Points to the words on the page and says, **"Look at these words. Put your finger on the picture these words tell about".** (Do not read words to the participant).



yellow bird

Correct: Points to the picture of the yellow bird.

Item 3:

Researcher: Points to the picture on the page and says, **"Look at this picture".** Points to the sentence and says, **"Listen. This says, 'The house is bigger than the …".** Point to the blank line in the sentence. **What word belongs in the**

blank space?"

The house is bigger than the _______.

Correct: Answers along the lines of man, woman, person, boy, child, lady, mom

Researcher: Points to the first item on the page and says, **"Read this to yourself and tell me one word that goes in the blank space"** (point to blank). Do not read items or tell subjects any words during this test.

Example with picture:

Something is in the wagon.
It is a _______.

Example without picture:

The drums were pounding in the distance. We could ___ them.

Correct: Hear

Incorrect: See