MEASURING MORPHOLOGICAL AWARENESS IN ADULT READERS: IMPLICATIONS FOR VOCABULARY DEVELOPMENT

By

LISA KAY MAAG

A DISSERTATION PRESENTED TO THE GRADUATE SCHOOL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

UNIVERSITY OF FLORIDA

2007

In memory of my parents

ACKNOWLEDGMENTS

I thank my family and friends for their support during this endeavor. I also thank my committee members for their patience and their advice, especially my Committee Chair, M. Jeffrey Farrar. In addition, I want to thank all of the staff of Project Care, particularly Fonda Eyler, Marylou Behnke, Kathleen Wobie, and Ann Welch, for making my time at the University of Florida rewarding and enjoyable.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Abstract of Dissertation Presented to the Graduate School
of the University of Florida in Partial Fulfillment of the
Requirements for the Degree of Doctor of Philosophy

MEASURING MORPHOLOGICAL AWARENESS IN ADULT READERS: IMPLICATIONS FOR VOCABULARY DEVELOPMENT

By

Lisa Kay Maag

May 2007

Chair: M. Jeffrey Farrar
Major: Psychology

Morphological awareness (MA) is considered a prime force in children's vocabulary growth, but this skill has scarcely been measured in adults. This study tested a method for assessing MA using complex (multimorphemic) words and a two-stage process designed to elicit explicit morphological knowledge. Participants, 106 college students, indicated which of the complex words they knew and were tested on morphological analysis and on definitions of the words. For example, correct responses on the morphology test would indicate that *readmission* is related to *admit* (and not to *mission*) and that *presumptuous* is based on *presume* (and not *sumptuous*). A standardized test, the Nelson-Denny Reading Test (ND), was also administered. Two metalinguistic scores were derived: MA was calculated for known words for which the morphological base word was identified, and Accuracy was based on known words for which the correct definition was selected. Participants with better ND Vocabulary and Comprehension scores also had higher MA scores and greater metacognitive awareness of their own lexicons. An inadequate vocabulary is one cause of reading problems, and a method that extends MA research to an older age group allows further research into vocabulary development with implications for remedial strategies.

CHAPTER 1
OVERVIEW

In the process of growing up in a literate society, most young people gain a large vocabulary, and word learning can continue throughout the lifespan. It is hard to appreciate the scale of this achievement because no one knows precisely how many words are learned. There is an enormous research literature describing the early years of language development, and many mechanisms of word learning have been identified in young children. There is also a large research base about learning to read and the related gains in language ability during early years of schooling. Most of the research has focused on how communication ability develops in childhood, and less is known about vocabulary development in adolescents and adults. There is still no complete explanation for the vast word-learning accomplishment of the first 15 or 20 years of normal development.

In English, most words in a child's vocal repertoire are of Anglo-Saxon origins, such as *house, hand, good, walk, cold*, and *who*. The Anglo-Saxon words are usually only one or two syllables long, and these simple words must be learned individually. A child may learn something about a word from hearing it once, but word learning is often extended, and knowledge of words is built up incrementally. Hearing or reading a word in an informative context can generate some learning, but many words may require multiple exposures to provide the young learner with sufficient understanding.

In school, as the child encounters more sophisticated language, big words become more common. Many big words are of Latin and Greek origins, such as *eradicate, complementary, paradigm*, and *consequential*. Many of these big words are formed through derivations: *act* (verb) can become *active* (adjective) or *action* (noun), and these lead to *transaction, activation, proactive, reactionary*, and more. The prefix *trans-* is also used in *transport*, which is related to

import, export, deportation, and *deportment*. The suffixes *–ation* and *–ment*, while difficult to define, indicate a state or condition of something, and these two suffixes signal nouns. This sharing of morphemes among derived words creates a vast network of word relationships, and this quality means that many of these words do not have to be learned separately. New words made of familiar parts might be understood spontaneously, or a new word may be at least partially understood if some of the morphemes are recognizable. For example, a student who knows the words *biology* and *geology*, might not know the root of *seismology*, but would probably realize that the word is a noun and refers to some area of study. In this way, learning complex words provides leverage that assists in additional vocabulary gains.

Everyday speech tends to use the frequent words that are known by almost all native speakers, while the longer, derived, less common words occur more often in formal, written text. As students move into fourth grade and beyond, the vocabulary of textbooks increases in complexity and difficulty. As these vocabulary demands increase with increasing grade level, the more difficult words may also include helpful clues—but only for the skilled language users. Poor readers who have not gained sufficient experience with derivational morphemes may struggle to master the new words.

A thorough knowledge of vocabulary depends on concrete knowledge of specific words, plus the understanding of the connections that exist among derivationally-related words. Most conventional vocabulary tests measure the grasp of word meanings, and tests that assess the understanding of morphology are seldom used, except in some research studies.

Two highly influential studies have examined the conditions of English vocabulary-learning, and these papers prompted the current study. In the first study, Nagy and Anderson (1984) analyzed the words found in typical school materials through grade 9, and determined

that the teaching of vocabulary would fall short because there are too many words to be taught. They concluded that children must be gaining much of their vocabulary through reading, and by making inferences about words that are semantically transparent.

Anglin (1993) interviewed school children to learn about the depth and breadth of their word knowledge. The children were encouraged to try to explain words that they were unable to define. For example, one child who didn't know the word *treelet*, decided by analogy that it must mean a small tree because a piglet was a little pig. Anglin called this process "morphological problem solving" (p.5) and showed that understanding of multimorphemic words was low in first graders, but increased dramatically by fifth grade. He suggested that the ability to analyze the morphemes in complex words accounted for a large part of vocabulary growth.

In addition, a number of studies have examined children's ability to use morphemes, and the data show greater understanding of morphology at higher grades, with correlations between morphology skill and reading ability. An increase in morphology skill should serve both as a cause of and an effect of better reading. If this skill continues to improve with advanced reading, older students should have higher levels of morphological skill that can be useful in comprehending advanced text. Unfortunately, this area of research has not yet been extended past the middle school level, and the testing methods currently being used with children are too easy for older readers.

The goal of the present study was to investigate the morphological ability of young, (college-age) adults. If the analysis of morphology propels vocabulary growth, young adults should have morphological ability that matches their reading ability—skilled readers should have sophisticated morphology skills.

As another consideration, this study was designed to test the explicit knowledge of morphology. The importance of metacognitive skills to reading has been proposed, but has not had much testing other than in the area of phonological awareness. There have been studies showing the value of self-monitoring of comprehension during reading, but other metalinguistic skills have received little attention in research on reading. Phonological awareness refers to the ability to explicitly reflect on and manipulate phonemes, and this skill is a key to successful reading acquisition. Once the basic reading processes have been mastered, the importance of phonological awareness may decline. Other skills may be essential for advanced reading, and morphological awareness (MA) is one likely candidate.

To tap explicit awareness of morphology at adult levels of skill, a two-step method was used. First, the study participants were asked to look over a list of complex words and to check the words they knew. The second step asked them to identify the morphologically simpler words from which the complex words might have been formed, and a multiple-choice format was used. As examples, a person with good MA would know that that *readmission* is related to *admit* (and not to *mission*), and that *presumptuous* is based on *presume* (and not *sumptuous*). A third section tested the participants' knowledge of the meanings of the complex words. A standardized reading test was also administered, and correlations between the new test and the standardized test were used to assess the new method. The positive correlations between the reading test norms and the morphological test suggest that this area deserves more study in the quest to explain vocabulary development.

CHAPTER 2
INTRODUCTION

Estimates of Vocabulary Size

Infants enter the world already recognizing their mother's voice, and with a preference for that particular language, but it takes around one year for a baby to begin to produce words. From the single-word stage, it may be another few months to a year before two-word phrases appear. By the age of two, a child can know hundreds of words, and many children will be speaking in sentences. The spoken words comprise the toddler's productive vocabulary, and the receptive vocabulary (words that are understood) is even larger. After breaking into language gradually, most children make huge gains in vocabulary throughout the first few years of life.

Measuring an individual's vocabulary might seem simple, but it is very difficult to accurately assess vocabulary knowledge. There have been many estimates of vocabulary size for different ages, and the totals vary tremendously. At 12 months of age, when most children are beginning to produce single words, some children have a vocabulary of 52 words and others have zero (Bates et al., 1994). A typical first-grader may know 2,700 words (Dolch, 1936) or 26,000 (Shibles, 1959). With older students, the estimates diverge even more. An average college student may have a vocabulary of 17,000 words (Goulden, Nation, & Read, 1990; D'Anna, Zechmeister, & Hall, 1991), or 200,000 words (Hartman, 1946 cited in Anderson & Freebody, 1981).These disparities are partially due to actual large-scale differences in vocabulary size, but they also reflect different approaches to the measurement of word knowledge.

There are many factors that complicate the measurement of vocabulary. Given a checklist, a parent can describe an infant's entire vocabulary in only a few minutes. By the age of 3, a child may say as many as 20,000 words per day (Wagner, 1985), and recording the child's entire

vocabulary may no longer be feasible. Due to the breadth of vocabulary after age 2 or 3, most measures of vocabulary size rely on sampling procedures, from which the total vocabulary can be estimated.

The most fundamental problems include defining what is meant by 'a word,' and determining what constitutes word knowledge (Lorge & Chall, 1963). Even dictionary editors do not agree on how to define "a word," and different publishers use somewhat different criteria for determining the main word entries. Most researchers and dictionary editors count a basic word and its regular inflections as one word, such as *look*, *looked* and *looking* (but for a dissenting view, see Miller and Wakefield, 1993). Irregular forms of words, such as *go* and *went*, are often counted as separate entries, but some dictionaries list irregular verbs under the basic entries. Derived words are usually counted as separate entries in dictionaries, but vocabulary tests vary in the treatment of derivations. Some vocabulary estimates would count *happiness*, *unhappiness*, and *happily* as one word, while others would count each variation as a separate word. Homographs and compound words add additional problems. *Bear* can mean a large mammal or to carry, and this could be counted as one word or two words. Such decisions have a tremendous impact on any attempt to count words.

Another problem in measuring a person's vocabulary is that there is no simple definition of what it means to know a word. Supplying or recognizing a synonym or definition is often used as the criterion for knowing a word, but meaning is only one aspect of word knowledge (Nagy & Scott, 1999). Testing knowledge of word meanings is complicated, especially for words with multiple meanings.

One method of conceptualizing word knowledge used a scale with 4 levels (Dale, 1965). A person might (1) never have seen the word before; (2) know that it is a word, but not know the

meaning; (3) know the general idea of a word; or (4) know a word well. Durso and Shore (1990) described a continuum of word knowledge, anchored by 2 endpoints: unknown words, or those that had never been encountered, and known words, which are part of a person's productive vocabulary. In between stretches a landscape of words ranging from slightly known to fairly-well-known words. Some of the most detailed characterizations of word knowledge have been devised in the area of second language learning. One classification system specifies nine aspects of knowledge of a word, including categories of receptive and productive knowledge about the word's form, its meaning, and its use (Nation, 2001). These various models show that there is no single, precise definition of knowing a word. Even at the lowest levels of knowledge, word understanding can be difficult to pin down. A person with only a very vague understanding of a word's semantic content might still be able to select a correct definition on a test. Conversely, a person might possess a fairly thorough knowledge of a word, but not recognize the particular definition used on a test. Few standardized vocabulary instruments investigate depth of word knowledge, and most simply test for some degree of knowledge of the most common meaning. Each method of measuring vocabulary involves trade-offs between efficiency and usefulness of the results, and the chosen testing method will depend on the purpose of the test and the available resources.

These fundamental issues in vocabulary measurement suggest that reports of absolute vocabulary size must be viewed with caution. Different measures of vocabulary cannot be directly compared unless they used similar definitions of a word to measure vocabulary breadth, and used similar criteria for knowing a word to determine depth of word knowledge. It is simpler to assess relative vocabulary, comparing performance on specific vocabulary tests, or to measure particular types of vocabulary knowledge.

Measuring knowledge of root or basic words is one way to avoid the word definition problem. Root words or basic words are not inflected or derived, and must be learned individually. For example, a child would have to learn the meaning of *think*, but would be assumed to know the inflected forms: *thinks*, *thinking*, and even the irregular past tense, *thought*. By one account, children older than second-graders can gain about 1,000 basic words per year (Biemiller & Boote, 2006). Using basic words to estimate vocabulary size is a sensible accommodation to the problem of defining separate words, but such a count does not fully indicate the depth or quality of a person's word knowledge. To make better use of the basic word measure, an additional measure would be valuable: the extent to which the word learner can use morphological clues to interpret complex words formed from basic words. Such a measure would indicate recognition of word families, as in knowing *think* and understanding its derivations: *thinkable, thoughtful, thoughtless, unthinkingly, forethought, afterthought, rethink, methinks, overthink, think tank*, and *groupthink*. This is the ability that would be rated with a test of morphological awareness (MA).

Due to the methodological problems, we do not know precisely how large an adult's vocabulary is, but we know that the numbers are large. Accounting for the rapid increase in word knowledge that begins in childhood and continues throughout adulthood is even more complex, and likely involves multiple learning strategies.

Theories of Vocabulary Development

Several theories of language development offer explanations for the rapid expansion of children's language competence. One explanation for the linguistic ability of infants is that they possess innate principles, constraints, or biases that guide word learning. For example, children often assume that a new word applies to something for which they did not already have a name. This is called the *mutual exclusivity principle* (Markman, 1990), or the *novel name-nameless*

category principle (Golinkoff, Shuff-Bailey, & Olguin, 1995). A variation is the principle of contrast that states that no two words mean exactly the same thing (Clark, 1993). The *whole object bias* is another principle that would simplify word-to-referent mapping, and a taxonomic bias would guide the extension of the word to similar objects (Markman, 1990). Using these guidelines, a child would assume that the word *cat* refers to the entire animal, and not just to its fur, its tail, or some other feature, and that *cat* also applies to other creatures that look like a cat. Some constraints theorists have maintained that these are innate properties, but others have proposed developmental pathways for constraints. For example, one set of multiple constraints has been proposed, beginning with three basic principles that get word learning off the ground, and evolve into three more sophisticated principles (Golinkoff et al., 1995).

Regardless of the source of these word-learning processes, they are generally thought to be specific to language acquisition. Other language researchers insist that such principles or constraints are unwarranted. One criticism is that constraints tend to be invoked more for noun learning than for other classes of words. This implies that other guidelines are needed for other word classes and the child would need to know when to apply which guidelines (Nelson, 1988).

Some argue that general learning processes are sufficient to explain vocabulary gains and that dedicated word learning mechanisms are unnecessary. The shape bias is another principle that enables children to apply a newly learned noun to other objects with similar forms, but Smith (1999) describes this as an emergent, not innate, mechanism. Markson and Bloom (1997) showed that 3- and 4-year-olds learned novel facts as readily as novel words, concluding that a dedicated word learning system is unneeded. Similarly, Samuelson and Smith (1998) explained examples of word learning through memory and attention, asserting that specialized skills for words are unjustified.

Another argument against constraints revolves around the familiar, recurrent routines in which adults and young children engage. Ritualized behavior sequences help children recognize actions and objects and link them as referents of the adults' words. Studies of joint attention have shown the value of adults noticing and describing the focus of the child's attention. For example, when children were videotaped at 15 and 21 months in play sessions with their mothers, more conversation occurred during episodes of joint attention than outside of these episodes (Tomasello & Farrar, 1986). A positive correlation was found between maternal references to the object of joint attention and the child's language at 21 months.

Different parental styles of speech have also been differentially associated with patterns of word acquisition. Mothers' speech to their 13-month-olds was coded both for pragmatic intent and whether or not each statement followed the infant's focus or introduced a different object of focus (Akhtar, Dunham, & Dunham, 1991). Only the prescriptive commands that followed the infants' attention had a large positive correlation with the infant vocabulary measure at 20 months. Mothers' statements that redirected their children's attention were not correlated with later language skills.

The child is not merely a passive recipient of adults' word instruction. Although labeling is commonplace (at least among middle-class, English-speaking parents), most words are probably learned without explicit teaching (Tomasello & Barton, 1994). According to the social-pragmatic view, the child uses an understanding of the communicative intentions of others to identify a word's meaning (Tomasello, 1995). By 18 months, children have some understanding of others as intentional agents, and the joint engagement of adult and child is no longer as critical to semantic gain. The child's growing understanding of others allows insight into word referents that may not be made explicit. In one study, children 19 to 20 months of age heard an adult use a

novel word (It's a *modi*!) while looking at a toy (Baldwin, 1993, p. 836). Half of the children (in the coincide condition) were given the toy immediately after the adult's exclamation. In the conflict condition, children were given a different toy during a 10s delay, before they were handed the toy that the adult had labeled the *modi*. In both conditions, the children were relatively successful at identifying the object called a *modi*, demonstrating that they noticed and correctly interpreted the adult's intentions and were not using associative learning to link an object and label.

Overhearing words and inferring their meanings may contribute a substantial portion of word learning (Akhtar, Jipson, & Callahan, 2001). By the age of two-and-a-half, children learned action verbs or names for objects equally well whether they overheard the word or were spoken to directly. Slightly younger children (with a mean age of 25 months) could learn nouns through overhearing them, but were less successful with action verbs.

There is ample evidence that social intentions provide very powerful clues to word meaning. Even when distracted by a more interesting, remote-controlled toy, 2-year-olds were able to learn the name for a less salient object that was labeled by an adult. In other words, social cues had more influence than an attention-grabbing toy (Moore, Angelopoulos, & Bennett, 1999). Still, an overreliance on social-pragmatic information as the one-and-only path to word meaning may be unwise (Baldwin & Moses, 2001; Hoff & Naigles, 2002). Many autistic children who seem to lack social referencing skills manage to acquire an adequate vocabulary (Baldwin & Moses, 2001). Another problem is that joint attention may not occur frequently enough to be a rich source of input for infants (Hoff & Naigles, 2002). In the 'data-providing account' of Hoff and Naigles, the primary source of semantic information shifts as a child learns more about language (2002). For young children, the mother's sensitivity to the child's attentional

focus and provision of appropriate cues may supply the best entry into word learning. By 18 months, children usually have sufficient understanding of others' intentions to figure out many word meanings on their own. As children's linguistic knowledge increases, the information from conversations may become the predominant source of new semantic understanding. That is, by 24 months, children can use syntactic and lexical clues to learn about unfamiliar words, and the greater the conversational richness and quantity, the more information the child has to work with.

In English, word order also provides many clues about meaning (Gleitman, 1994). For example, when preschoolers heard the sentence "this dog is named Daxy" they interpreted the novel word as a proper name (Hall & Graham, 1999, p.82). When the word appeared in the sentence "this dog is very daxy" it was assumed to be an adjective, referring to a quality of the dog. The 4- and 5- year-olds were willing to let two adjectives refer to the same dog, but not two proper names, showing that they understand something about the functions of these two word classes.

Verbs may be more difficult to learn than object labels, and verbs are seldom explicitly taught as are nouns (Gleitman, 1994). Verbs play an important role in the shift from one word speech to multiword utterances (Olguin & Tomasello, 1993). By the age of 2, children can use new nouns flexibly, suggesting that they have an apparent category for count nouns. Before age 3, verbs are acquired individually and children use them only in restricted forms. Eventually children acquire sufficient experience to abstract patterns of verb use and develop a syntactic category for verbs. By the age of 3 or 4, most children readily add new verbs to their vocabularies and produce them in appropriately inflected forms, implying that they have an abstract category of verb. Overgeneralizations of irregular verbs, for example, rarely occur before this age (Tomasello, 2001).

Other types of language knowledge contribute to learning word meanings. Linguistic information within an utterance can help a child determine the meaning of an unfamiliar word. Two-year-olds can use their understanding of familiar verbs (such as *eat, ride*, or *spill*) and their general knowledge to infer the meanings of unfamiliar nouns (Goodman, McDonough, & Brown, 1998). Children listened to sentences such as "*Mommy feeds the ferret*," and were asked to pick out the target noun *ferret* from a page with drawings of 3 inanimate objects and 1 small mammal. The 24- and 30-month old participants correctly identified a novel noun an average of 4.3 times out of 10. Thus, by the age of 2 or 3, children can draw on an array of cues to figure out the meanings of new words.

Young children have many strategies for figuring out new words and use multiple methods for doing so (Hirsh-Pasek, Golinkoff, & Hollich, 2000; Akhtar, 2002, Bloom, 2000). It is probably safe to assume that older children can use the same methods and apply them more skillfully. We know that preschoolers have social referencing skills and can use others' intentions to determine word meanings. By the age of 4 or 5, children have developed a more sophisticated theory of mind, so that their understanding of others' sources of knowledge can help them make inferences (Baldwin & Moses, 2001). Preschoolers have much more general knowledge than toddlers to help them narrow down the possible referents of words. They are more experienced with complex syntax and can take advantage of contrasts and cues within sentences. Older children possess a considerable vocabulary and can use known words to figure out novel words. These provide a broad repertoire of skills that can be applied to learning the meanings of novel words.

As children reach school age, the research has focused more on reading skills than on oral language skills. Although a substantial amount of learning from oral conversation undoubtedly

continues during the school years, there is a dearth of evidence on this topic (Beck & McKeown, 1990). The connections of oral language skills to reading skills have only recently begun to be investigated in detail (Ouellette, 2006). Most theories of language development have focused on explaining the mechanisms by which young children gain a foothold in language, and theories of reading address the development of reading at later ages. There are, as yet, few solid links between these two theoretical areas. A closer examination of vocabulary and morphology skill can contribute to the understanding of language development from childhood into adulthood.

The Basics of Morphology

Morphology plays an integral part in the formation and comprehension of English words, and yet morphemes seem underappreciated. Morphemes, which include roots, stems, prefixes, and suffixes, are the smallest parts of words that carry meaning. They are usually larger than phonemes and smaller than words. Although we may think of words as being composed of letters, it is more accurate to note that words are spelled with letters for the purpose of putting sound into written form. Words are actually composed of morphemes, which link sound and meaning. Being able to utilize this intermediate level of language is central to building a vigorous vocabulary and comprehending English text.

Morphology refers to the use of or the study of morphemes, the components of words that convey meaning. The precise role of morphology varies with each language, depending on the word formation processes used in each language. It is not even certain that there is a universal role of morphology that applies to all languages (Libben & Jarema, 2004), and in this paper, the focus will be limited to English.

Monomorphemic words (such as *window, sleep,* and *elephant*) are also called root words or basic words and must be learned individually. Multimorphemic words, such as *autobiography*, *distrustful,* and *worthiness*, are composed of concatenated morphemes. The term *complex word*

is often used in vocabulary studies as shorthand for multimorphemic word. In the words *talking, talkative, backtalk,* and *double-talk*, the root word *talk* is a shared morpheme that links the words semantically. Root words and stems are modified by inflectional and derivational morphemes that convey syntactic and semantic details. Inflectional changes reflect grammatical functions of words, with changes of tense, person, and number. Inflections do not change a word's class, or part of speech, as in the examples *book/books, walk/walks/walked/walking*. Changes in derivational morphology allow a root word or stem to occupy various word classes, as in *know* (verb), *knowingly* (adverb), *knowledge* (noun), and *knowledgeable* (adjective). Derivational changes usually create longer words and are generally more complex than inflectional processes.

Morphemes supply the raw materials for creating new words, and the agility of morphemes provides part of the generative power of the English language. Many new words are readily understandable because they are composed of familiar morphemes, such as these additions to a popular dictionary in 2006: *biodiesel, ringtone, spyware,* and *agritourism* (Merriam-Webster, 2006). Noticing the root word inside a complex word, and recognizing prefixes and suffixes are strategies for figuring out novel words, and skilled readers seem to do this effortlessly and automatically. With a healthy working knowledge of English morphology, a person can learn new words ‘on the fly.’

Recognizing and understanding morphemes simplifies the child’s job of word learning. Nagy and Anderson (1984) estimated that for each word learned, a child could understand three others. If every single word had to be learned independently, the vocabulary-learning task would be much more cumbersome. Yet even with this morphological leverage, word-learning is a protracted endeavor**.** To appreciate the task of learning a vocabulary in one’s native language,

several factors should be considered: the volume of words that must be learned, the networks of lexical relationships among words, and the opportunities to learn complex words.

The data about morphology knowledge show that children use many sources of information from both speech and reading, and that they need extensive experience with language to fully grasp English morphology. The use of specific verbs and the production of particular syntactic constructions can be shown to coincide with the frequency of the input (Kidd, Lieven, & Tomasello, 2006). This type of usage-based approach would account for the progression of morphology learning, because growth in morphology knowledge can be seen to parallel the frequency of the morphemes. For example, the ability of elementary school students to analyze prefixed words is related to the frequency of the prefixes (White, Power, & White, 1989). As research on morphology skill gains more attention, the theoretical background should be examined more extensively, but one conclusion seems clear: children need ample input for acquiring morphological word knowledge.

Exposure to Words: The Language Environment

The volume of language and the type of words to which a child is exposed will shape the child's vocabulary. The number of words can vary tremendously, as was shown in a longitudinal study of 42 children and their families (Hart & Risley, 2003). The total number of words and the number of different words that children heard varied with the families' SES levels. Children in higher income homes both heard and spoke more words than children in low income families. Over the age range of 13 to 36 months, the children of high income families heard an average of 2,176 words (total) per hour, and 382 different words per hour. In families living at the poverty level, the children heard an average of 974 words per hour, and about 167 different words per hour. By the age of 3, the high SES children had vocabularies of about 1100 words, and the children from low SES homes had about 500 words in their vocabularies.

Even in families with well-educated parents, very frequent words predominate in typical parent-child conversation (Hayes & Ahrens, 1988) and rare words are most likely to crop up during book reading or during mealtime conversation (Beals, 1997; Beals & Tabors, 1995). For example, a study that analyzed the conversations of mothers and 5-year-olds found that less than 1% of the words were "sophisticated" words (outside of the most frequent 3,000 words), and some children did not hear any less-frequent words in the conversations (Weizman & Snow, 2001).

By the time children enter school, differences in their vocabularies can be large. There is typically little vocabulary gain in the primary grades because of the emphasis on learning to read. Children are learning to recognize words in print that they already know, so few new words are introduced (Chall & Jacobs, 2003; Becker, 1977). By the end of second grade, children in the upper quartile of vocabulary skill may know an average of 8,000 root words, and children in the lowest quartile average 4,000 root words (Biemiller & Boote, 2006) Schooling in the primary years seems to do little to augment vocabulary (Christian, Morrison, Frazier, & Massetti, 2000), which means that vocabulary gaps would persist.

The Distribution of Words: Word Frequency

The American Heritage Word Frequency Book (or WFB) examined the range of words used in school materials for grades 3 through 9 (Carroll, Davis, & Richman, 1971), and was based on a corpus of over 5 million word tokens. The word distribution data in this volume put the word-learning endeavor in perspective. The most common 1,000 word types comprised 74% of the word tokens, and the first 5,000 types made up almost 90% of the corpus. This makes learning the English language seem easy: knowing 5,000 words should cover 90% of the printed material that would be encountered through the ninth grade. On the other hand, about 40% of the word types turned up only one time in the total corpus of 5 million words. This means that

beyond the first 5,000 most common words, the opportunities to learn specific words may be very sparse.

Nagy and Anderson (1984) examined the WFB words to better describe the vocabulary-learning task, and in part to assess whether this level of vocabulary could feasibly be taught. They selected a random sample of over 7,260 words in the form of 121 “chunks” of 60 adjacent words. The words were grouped into word families consisting of a base word and all of its inflections and derivations. A judgment of “semantic relatedness” indicated how transparent or opaque a target word’s meaning would be to a child familiar with the base word (p.310). For example, an English speaker who knows *crowd* would readily understand *crowded*, but the link between *vice* and *vicious* might not be as obvious. Based on their categorizations of relatedness, Nagy and Anderson added the number of basic words (about 45,000), and the semantically opaque words (over 43,000) to conclude that printed school English contains 88,533 distinct word families. Roughly 139,000 words ought to be transparent, so that no additional effort is needed to understand them. By adding in 'essential' proper nouns, the number of words a student would need to learn came to about 188,000. Nagy and Anderson concluded that words must be extensively learned through reading, because it is inconceivable that this volume of vocabulary could be explicitly taught. Their analysis also showed that basic words tend to be among the more frequent words, and the derivationally-complex words make up more of the infrequent words.

Even with these analyses, it is not clear how many words a child needs to learn, but by most vocabulary methods, the reckoning would be at least tens of thousands. Many of the words are related, and by understanding the word formation processes of English, learning one basic word might increase the total vocabulary by a count of several words. In actuality, a word’s

meaning may not be completely understood from one encounter, but a reasonable approximation of meaning might be gained by parsing a complex word into its parts. The extent to which a child or older reader can 'extrapolate' from basic words to related complex words has not been well-documented, and it is this word analysis skill that is the main concern of this paper.

Where the Big Words Are: Why Reading Experience is Necessary

According to one estimate, by the time children enter school, most have a basic vocabulary of the 5,000 or so most common words, learned through conversation and by watching television (Hayes, 1988). Additional lexical knowledge is contingent on "contextually rich settings" (p. 584), and exposure to words in print.

Children typically master inflectional word changes early in life (Anglin, 1993; Kuo & Anderson, 2006), but the derivational manipulations of morphemes are much more varied and require more extensive exposure to language. Although learning about morphemes begins with spoken language, everyday conversation is unlikely to provide a thorough grounding in morphological processes.

Rare words—defined as those occurring less than 3 times per million words—are truly rare in conversation and on television, and exposure to these less common words occurs largely through reading (Hayes, 1988). It is the low-frequency words that tend to be morphologically complex, and transparent derived words are more common in advanced text than in low-level material or everyday conversation (Nagy & Anderson, 1984). This means that a considerable amount of reading is needed for exposure to the less-frequent, complex words and to develop an understanding of morphology.

When children learn to read, they are initially learning to recognize the orthographic forms of words they already know (Adams, 1990). Around the fourth grade, the purpose of classroom materials changes from learning to read to reading to learn (Chall & Jacobs, 2003). The higher-

level reading matter encompasses a broader range of vocabulary with more low-frequency words, and the proportion of derived, morphologically-complex words increases. It is usually the difficult, multimorphemic words that communicate the key concepts (Cunningham, 1998; Hayes, Wolfer, & Wolfe, 1996). This steep change in reading content can lead to a "fourth-grade slump" (Chall & Jacobs, 2003, p.14) in which children who managed beginning reading skills are defeated by the vocabulary load. At the same time, good readers have an advantage because much of the unfamiliar vocabulary consists of derived words. As much as 60% of the unknown words can be deciphered by analyzing the morphemes (Nagy & Anderson, 1984).

In addition to using longer, more complex words, the nature of academic vocabulary is different from the vocabulary used outside of school and research settings (Corson, 1997). Stemming from the history of the British Isles, present-day English language reflects successive incursions of people bringing different languages. As a result, many ideas can be expressed in English by words of Germanic origins (primarily Anglo-Saxon) and by words tied to Romance languages (including Latin and Greek). Everyday conversation favors the Anglo-Saxon words, while science textbooks and technical materials tend to use words of Latin and Greek origins. For instance, casual conversation might include the Anglo-Saxon words *belly*, *jaw*, or *skull*, but in science writing, the Latin terms *abdomen, mandible*, and *cranium* would be more common (Maylath, 1997). With its reliance on Greco-Latin word roots, the formal language used in advanced academic or research writing has been likened to a second language for English speakers who lack extensive academic reading experience (Corson, 1997). The notion of academic vocabulary is difficult to define precisely, but it includes the sub-technical or semi-technical words that are used in many academic fields, such as *phase, inherent, establish*, and *analyze* (Nation, 2001). This category makes up about 8.5 to 10% of typical academic text

(Chung & Nation, 2003; Nation, 2001; Coxhead, 2000), so even within this genre, the important words are not high in frequency.

In the early stages of reading, morphology skill may not be essential, but by late elementary or middle school, knowledge of morphology takes on increasing importance in reading comprehension (Nagy, Berninger, & Abbot, 2006). This situation can be a boon for avid readers and a double whammy for struggling readers. Compared to speech, academic reading material both provides a more intensive exposure to morphology and requires higher levels of skill. There appears to be a bi-directional relationship in which reading contributes to morphological skill, and morphological skill enables reading (Nunes, Bryant, & Bindman, 2006; Nagy, Berninger, Abbott, Vaughan, & Vermeulen, 2003; Voerhoeven & Carlisle, 2006).

Time Spent Reading

In the nation's "Reading Report Card," fourth-grade children described the frequency of their reading for pleasure (Donahue, et al., 2001). Forty-three percent reported reading every day; 32% indicated 1 to 2 times per week, and 26% reported that voluntary reading occurred less than twice a month. These were self-report data, and there is no information about the amount of time spent reading. Another measure of reading time involved children aged 3 to 11 who reported their daily activities by means of a time-diary survey (Bianchi & Robinson, 1997). Trained interviewers asked the children (or parents of younger children) to account for their time for the previous 24 hours. Only 27% reported doing any reading on the previous day, but 89% watched television. Across the entire sample of children (n = 887), the average time spent reading was 12 minutes per day. Some of the children were too young to read independently, so the data include time in which someone read to the child.

In another study, 155 fifth graders were asked to complete logs to record their activities outside of school (Anderson, Wilson, & Fielding, 1988). The mean time spent reading books was

about 10 minutes per day, but with all reading combined (books, comics, mail, newspapers, and magazines) the mean reached about 18 minutes per day. The mean reading times may not be informative, because the range was "staggering" (p. 294). The median value for total time spent reading was 7.2 minutes. Students reading at the 90th percentile on a standardized test read 40 minutes per day, while students at the 10th percentile of reading ability typically read 1.6 minutes per day. By multiplying time spent reading by estimated reading speed, Anderson et al. calculated the average number of words read per year. The spread for the 10th to 90th percentile students is enormous: 8,000 to 1,823,000 words read per year.

A study of time usage also found that reading did not occupy much of a typical child's day (Hofferth & Sandberg, 2001). Time diaries were collected for over 2,800 children between 3 and 12 years old. For the entire sample, reading for pleasure took up about 1 hour per week, and television viewing occupied 12 hours per week. In a longitudinal study of children from first to fourth grade, a gap in time spent reading at home emerged between good and poor readers in second grade (Juel, 1988). By fourth grade, the skilled readers reported reading about 3.5 times a week, compared to once a week for the children with reading difficulties.

The amount of time spent reading in school appears roughly equal to the time spent reading outside of school. Many school districts subscribe to a trade book program that offers a wide choice of books and computerized evaluations of students' reading accomplishments. In a survey of schools using the Accelerated Reader (AR) program, the amount of reading per day was assessed using the points awarded for each completed AR book, providing a relative, rather than actual, estimate of reading time (Topping and Paul, 1999). Very few schools allotted the recommended 60 minutes per day to reading. Private schools allocated about 67% more time to independent reading than public schools, and small schools reported more reading time than

large schools. Higher reading skill was associated with more time spent reading, but it was unclear whether practice improved reading, or better readers chose to read more, or both. Consistent with other studies, there was an enormous difference in the amount of reading done by skilled and less able readers; readers in the top 5% read 144 times more than those in the lowest 5%.

Commercial programs supplying trade books to the schools offer popular, entertaining books that students self-select. These are very different from textbooks, and some researchers are concerned about the ability to read and learn from informational text. Familiarity with the genre of instructional text is important if students are to utilize printed resources in school (Duke, 2000). In a survey of 20 first-grade classrooms, Duke found that very few informational books were available and they were rarely used. Teachers seldom read aloud from these and students were unlikely to choose them for independent reading. On average, for all of the classrooms, the informational books were used for 3.6 minutes per day. The rate was higher in high-SES schools (3.8% of the time) than in low-SES schools (1.9% of the time).

These studies confirm that the good readers tend to spend more time reading, and that poor readers generally do very little reading. While any reading is likely to be beneficial, some reading materials do more to promote vocabulary gain than others. Without adequate exposure to the more complex vocabulary and syntax of academic or informational texts, it is unlikely that students will be prepared when they are expected to read textbooks on their own.

Morphology and Spelling

A knowledge of morphology is also important in spelling English words. While English is an alphabetic language with letters representing sounds, it is not purely alphabetic. Many words retain spelling that represents morphemes rather than phonology, such as *island, sewing, meant*, and *autumn*. Young children may start with a phonological spelling strategy, but with age and

increasing experience with writing, they gradually shift to a morphemic approach to spelling (Nunes, Bryant, & Bindman, 1997; Kemp, 2006). As examples, in the words *passed, called,* and *waited,* the past tense ending has the sounds /t/, /d/, and /id/, respectively. Learning to add the morpheme '-ed' on the end of regular past-tense verbs is a more successful strategy than trying to spell the sounds (Nunes, Bryant, & Bindman, 2006).

Measuring Morphology Skill

Previous Studies of Morphology Skill

Children's knowledge of English morphology has been examined with an assortment of experimental tasks. The earliest studies examined morphological understanding in a global sense, with more precise differentiation of types of morphology skill appearing in more recent studies. Many of the newer studies have focused on the acquisition of particular grammatical forms, using morphology to illuminate the development of syntax. Fewer studies have looked at morphology as a key to semantic understanding.

In a classic test of morphological knowledge, Berko (1958) tested participants ranging from young children to adults. By using nonsense words (such as *wug*), she could eliminate the effect of familiarity with actual words and test participants' understanding of inflections. Children did well with inflectional changes such as plurals, possessives, and verb inflections. To test knowledge of word derivation processes, Berko asked the children to explain the meanings of compound words. Although familiar words were used, such as *birthday, airplane*, and *breakfast*, the children did not seem aware of the etymological sources of the derived words.

Derwing investigated derivational knowledge by asking specifically about relationships between pairs of words (Derwing, 1976; Derwing & Baker, 1979). Participants were asked about examples such as *Does teacher come from teach? Does Friday come from fry*? Adults showed much more awareness of etymological relationships than children, who were more likely to agree

that *eerie* came from *ear*. Derwing's studies are significant because they elicited and made explicit the participants' understanding of related words, knowledge which ordinarily may seldom be verbalized.

Two studies revealed some clues about knowledge of derivational morphology in middle school students. In a study comparing average eighth graders to high-ability fifth graders, the students were asked to write definitions on a vocabulary test consisting of basic and derived words (Freyd & Baron, 1982). The fifth graders outscored the eighth graders, but the difference was greater for the derived words than for the basic words. This suggests that the high-ability students had greater understanding of derivational morphology than the average students. In another test of morphology skill, fourth, sixth, and eighth graders were taught the meanings of words on a vocabulary list, but were tested on words that were derivationally related to the training list (Wysocki & Jenkins, 1987). If students had learned *connivance* and *dote*, for example, they were tested on *connive* and *doting*. When asked to define the test words, they more often repeated the definition of the word learned during training, rather than adapting the explanation to reflect derivational change. While this indicates either limits to definitional skill or a lack of attention to morphological changes or both, it confirms recognition of the relationship between base and derived words.

Anglin (1993) studied vocabulary development by asking six- through ten-year-old children to define words, and he analyzed their responses. In the process of figuring out unfamiliar words, the children demonstrated their understanding of morphology. For instance, few of the children knew the word *treelet*, but some of the fifth-graders knew the word *piglet*, and could define *treelet* by analogy. Anglin called this process "morphological problem solving"

(p. 5) and showed that this skill could account for a significant part of the vocabulary increase in the older children.

In another study involving fourth, sixth, and eighth graders, students were asked to supply derivations in response to base words, and to name base words of derived forms (Carlisle, 1988). In the derivation task, students were given the example "warm/He chose the jacket for its ____" (p. 252), and an example of decomposition would be supplying the word *danger* in a sentence after hearing *dangerous*. The students did better at supplying the base words than derived words, and older students were more successful than the younger students. The most difficult word conversions involved phonological changes, in examples such as *width/wide, explanation/explain, admission/admit,* and *combination/combine*.

This age group has been a focus of study because the middle grades seem to be a time of active development of morphological understanding, and the skill takes on more importance in reading at this level. In a recent study, Carlisle (2000) administered her Test of Morphological Structure to third and fifth graders, asking for derivatives of base words and base words of derivatives (as described for her 1988 study). In addition, definition and word reading tasks were used, and reading comprehension and vocabulary tests were administered. The measures of morphology accounted for 41 to 53% of the variance in comprehension and vocabulary scores, with the fifth graders demonstrating higher levels of skill than the third graders. In both grades, students had more difficulty with complex words that require a shift in pronunciation (such as *production/produce*), than with transparent words (without phonological shifts).

In another report of this age group, students in third through sixth grades were tested to compare both morphological skill and phonological awareness with other reading skills (Mahony, Singson, & Mann, 2000). In the morphology test, adapted from Derwing's method,

pairs of words were presented and children were asked if the two words were related or not. In the first experiment, children who were better at word decoding also did better on the morphology test, and after controlling for vocabulary knowledge, morphology still made an independent contribution to decoding. The unusual finding was that, overall, correct choices on the morphology relatedness test appeared to be more closely tied to word frequencies than to the seeming transparency of word relationships. Most of the children in all grades agreed that *beauty* and *beautiful* are related, as are *decide* and *decision*, but less than 20% recognized the relationship in the word pair *allow/allowance*. Among the word pairs with a phonological shift, over 90% of children in all the grades knew that *add* and *addition* were related, but only about half the fifth and sixth graders agreed that *atom* and *atomic* were related. The second study suggested that while phonological awareness played a larger role in reading skill, morphological understanding also made a significant contribution.

Most studies of morphology have examined students in elementary and middle school. In one of the few studies to test older students, high school and college students were asked to interpret specially created complex words (Kaye, Sternberg, & Fonseca, 1987). The test words were formed from well-known prefixes and frequent base words, but the resulting words were novel combinations, such as *submove* and *compone*. Multiple-choice answers offered definitions based on the various combinations of affix and base meanings. Even the college students had trouble picking the correct definitions and their answers did not show a consistent strategy; sometimes they opted for a definition of the affix, and other times chose the definition of the base word. In other words, being asked to select definitions of many unfamiliar complex words seemed to be too formidable a task, even though the word parts were familiar. Thus, in contrast to studies of younger students, these participants did not routinely use the strategy of defining the

word parts in order to decipher an unfamiliar word. Although these participants were older, the words on which they were tested were unfamiliar, more numerous, and apparently, more challenging.

There have been other investigations of morphology use among older students, but these studies have looked at specific populations of readers. For example, a sample of deaf college students showed deficits in solving mathematical word problems, even though the students were capable of performing the relevant mathematical operations when presented in graphic form (Kelly & Gaustad, 2007). The difficulty seemed related to poor knowledge of morphology, and when matched on reading level to middle school hearing readers, the deaf students had lower scores on a test of derivational morphology (Gaustad & Kelly, 2006). The use of morphological knowledge by dyslexic readers has been explored, and various studies have yielded inconsistent results. One group of high-functioning dyslexics (college students) was found to process words with derivational changes more slowly than normal readers, but this effect was not found for inflections (Deacon, Parrila, & Kirby, 2006). Another study of college students with poor reading skills showed that the target students, compared to age-matched and reading-level-matched control groups, were slower at processing derivational word changes. In other cases (but with younger students), using morphology seemed to provide a compensatory skill with respect to phonological processing (Arnbak & Elbro, 2000; Casalis, Colé, & Sopo, 2004). With the various methods, age groups, and languages tested, we do not yet have a clear picture of morphological strategies used by dyslexic students and other poor readers.

In spite of its apparent value, derivational morphology receives little instructional time in formal education (Cunningham, 1998; Moats & Smith, 1992) and little is known about the level of this skill possessed by adolescents and adults. Higher levels of morphological knowledge have

been linked to better reading ability in the early grades (Carlisle, 2003; Nagy et al., 2003; Fowler & Liberman, 1995; Singson, Mahony, & Mann, 2000). The published studies leave many questions about the conditions under which a morphological analysis strategy would be applied in an encounter with a novel word. By middle school most students seem able to recognize the shared semantic content of common words, although they may not be skilled at defining words in terms of the correct part of speech. Although children and adolescents *can* analyze complex words for meaning, it is not clear that they regularly do this without prompting. Since learning about derivational morphology continues through high school (Nagy et al., 2003), and even into adulthood (Hurry, Nunes, & Bryant, 2005; Carlisle, 1988; Kaye, Sternberg, & Fonseca, 1987), it would be valuable to measure the degree to which adult readers can use their knowledge of morphology in understanding complex words.

In addition, while morphology is a valid level of language organization for linguists, its meaning for readers might better be investigated through studies of the metacognitive form, called morphological awareness.

Making the Case for Morphological Awareness

The process of learning to read, Nagy and Anderson have argued, "is fundamentally metalinguistic" (1995, p.5), and metalinguistic skill is the ability to reflect on various aspects of language. Learning to read depends on a particular form of metalinguistic skill called phonological awareness (or PA). This explicit awareness of the correspondence between sounds (phonemes) and letters has been definitively linked to progress in reading acquisition (Bradley & Bryant, 1983, Adams, 1990). Other metalinguistic skills have been implicated in reading, but with the focus on learning to read, PA has received the most extensive scrutiny.

Once children have mastered the basics of reading, word recognition becomes more rapid and automatic, and the reliance on phoneme-to-letter relationships declines. When they

encounter unfamiliar printed words, more advanced readers increasingly rely on morphemes in preference to phonemes (Verhoeven & Carlisle 2006). Several researchers have suggested that MA is a type of metalinguistic skill that is critical for efficient reading. Morphological awareness has been linked to early reading skills (Carlisle, 1995) and to children's spelling (Nunes, Bryant, & Bindman, 1997), and MA appears to gain in importance as reading difficulty increases in middle school and beyond (Verhoeven & Carlisle, 2006). Much is still unknown about MA because this research area is still in its infancy, especially when compared to the body of research on PA.

Young children can create new words from morphemes, but this does not imply that they possess explicit morphological knowledge (Clark, 1995). Although most adults who are proficient in English undoubtedly have considerable knowledge of morphology, for many people this knowledge remains "unconscious" (Hurry et al., 2005, p. 188). A clear distinction between morphology skill and MA has not been established in the research literature. One leading vocabulary researcher, William Nagy, has asserted that since much of morphology skill is tacit, assessments of morphological knowledge are in effect measurements of MA (Nagy et al., 2003). Just as PA researchers debate the various types of PA and its cognitive underpinnings (Savage, Blair, & Rvachew, 2006), the investigation of MA will undoubtedly need further refinement.

A commonly used definition of MA includes "children's conscious awareness of the morphemic structure of words and their ability to reflect on and manipulate that structure" (Carlisle, 1995, p. 194). The ability to manipulate morphemes can be demonstrated in young children, such as those who participated in Berko's Wug test (1958), but it is harder to show that conscious awareness is required.

There is no standardized format for measuring MA, and a variety of approaches has been used. Carlisle has used a sentence cloze task in which the child must change a word to fit the sentence, as in "*teach. He was a very good* ____" or, "*runner. How fast can she* ___?" (Carlisle, 2000, pp. 187, 188). Some items require the derived form to be produced from the base, and some ask the child to supply the base, given the derived form. Although this task involves the manipulation of some morphemes, it emphasizes the ability to add or remove suffixes, and to utilize irregular word forms, as in *wide/width*. Carlisle has claimed this taps explicit awareness (Carlisle & Nomanbhoy, 1993). In another MA study, children were asked to choose a nonsense word with the correct suffix, as in "He has lots of STIP now. He's very [STIPful, STIPy, etc.]" (Windsor & Hwang, 1999, p. 230). Another study used a task described variously as measuring "morpheme awareness" and "morpheme sensitivity." Participants were asked to choose the correct word to complete a sentence, in the form of "They were stopped by the _____" with the choices *tramicize, tramify, tramic*, and *tramity* (Singson, Mahony, & Mann, 2000, p. 248). In a study of second- through fourth-graders, students were given an analogy task of the form a:b::c:? which was described as a measure of "morpho-syntactic awareness" (Nunes, Bryant, & Bindman, 2006, p. 773). Examples were cried:cry::drew:__, and happy:happiness::high:___ (p. 785). Such experimental tasks may utilize the manipulation of morphemes, but many seem to draw heavily on a form of grammaticality judgment which might be made implicitly. These methods emphasize the syntactic properties of affixal morphemes, rather than functional manipulation of the base or stem morphemes that carry the semantic weight.

Other aspects of MA were assessed in two recent studies. Two types of MA along with other reading skills were measured in kindergarteners and second graders (McBride-Chang, Wagner, Muse, Chow, & Shu, 2005). The morpheme identification test asked children to pick

one of two pictures that represented the desired morpheme. For instance, with pictures showing the color blue and "he blew out some air," the child was asked to point to the picture that showed the same meaning of *blue* in *blueberries* (p. 423). To demonstrate understanding of morphological structures of words, the children were asked to create compound words to fit a described situation. As an example of this test, after being given an explanation of the word *sunrise*, a child would be asked what to call the moon coming up at night. Correlations of the two MA tasks with a standardized picture vocabulary test were between .34 and .50. After entering the PA and other reading scores in the first step of a hierarchical regression, the MA skills accounted for 10% of the variance in vocabulary for the combined sample of children.

In another study comparing the contributions of PA and MA to reading, fourth through ninth graders completed a battery of reading tests (Nagy et al., 2006). The MA tests included a judgment requiring recognition of a grammatically-correct suffix, and a version of Derwing's 'comes from' test, as in 'Does *moth* come from *mother*?' Using structural equation modeling, these forms of MA were found to contribute unique variance to the reading comprehension and vocabulary at each of the grade levels. The results suggested that MA played an increasingly important role in the reading skills as grade level increased.

These studies show that MA contributes to reading facility in various ways, and more specific means of classifying MA skills are needed. Weng, Cheng, and Chen (2006) have proposed four categories of MA, including the identification of morphemic components in complex words, the discrimination of morphemes from similar-sounding words, and the manipulation of morphemes to produce syntactically-correct words. The fourth proposed category, interpretation, refers to the ability to infer the appropriate meaning of complex words from their morphemes, and this is the skill of most interest in this study. The ability to extract

meaning from word parts would be valuable for reading advanced level text, and it has rarely been tested using college-level vocabulary and readers beyond middle school.

A few studies have shed light on this semantic or interpretative form of MA by interviewing participants and asking them to explain how they figured out word meanings (Anglin, 1993; Baumann, Edwards, Font, Tereshinski, Kame'enui, & Olejnki, 2002; Freyd & Baron, 1982). This method provides a detailed, step-by-step rendition of the processes children use to decipher unknown complex words. While these introspective reports provide useful information, such time-consuming procedures limit the number of participants from whom data can be collected and the number of words that can be tested. One goal of the present study was to develop an instrument that could be administered to a group of participants in a relatively brief time.

While many researchers agree that MA is important, there is no consensus on how to categorize it or how to measure it, or even how to tease it apart from a basic-level, non-metacognitive morphological knowledge. The existing studies are largely confined to young readers, so little is known about the influence of MA on more advanced reading. Although the value of MA in understanding complex words is acknowledged, there is little empirical evidence of this application of MA. In response, the main goal of this study was to measure MA as it contributes to semantic understanding, to test a measure appropriate for adult readers, and to make sure the task utilizes explicit word knowledge.

The Rationale for the Morphological Awareness Measure

In this study, MA was assessed through a roundabout, two-step route. The method is based on the assumption that a person who knows a complex, derived word should know the base word which is more frequent, and therefore, normally learned earlier. For example, someone who knows *disagreement* should also know the word *agree*. The word *agree* would be expected to be

learned within the first 2,000 words of English, whereas *disagreement* is ranked at about the 14,000-word level (Carroll, Davies, & Richman, 1971). It is hard to imagine that the relationship between words such as *agree* and *disagreement* might not be recognized, but both are fairly frequent words. The derivational relationships of less common complex words and their bases may be less obvious, such as in *beneficiary* and *benefit* or *judicial* and *judge*. Recognition of derived words appears to involve awareness of the word family (Marslen-Wilson, Tyler, Waksler, & Older, 1994; McKinnon, Allen, & Osterhout, 2003; Nagy, Anderson, Schommer, Scott, & Stallman, 1989), so claiming knowledge of a complex word implies the understanding of its derivational relationship to the basic word.

In the first step of this study, the participants were presented with a list of 50 complex words, and were asked to check the words that they know. It was assumed that participants would check words for which they knew the general meaning.

The second step presented the same list of 50 words, and asked the participants to identify a base word to which each complex word is related. Sample items include

_____ **believable**	a. belief	b. belie	c. lie
_____ **discredited**	a. disc	b. credit	c. edited
_____ **explanatory**	a. plane	b. planetary	c. explain

By itself, the second step could be seen as a measure of basic-level morphological skill, and for this, knowledge of the particular words would not be necessary. To extricate MA from this procedure, the results of the second step were examined with respect to words checked as known in the first step. In other words, to demonstrate MA, the participants needed to indicate that they knew specific words *and* to show they knew the morphologically related words. This

two-stage sequence makes explicit the knowledge of morphological relationships that may normally be used implicitly.

The multiple choice format for the morphology task allows a higher level of difficulty so that the measure is appropriate for adults. The results of the newly-created morphology test were compared to the participants' scores on a standardized test, the Nelson-Denny Reading Test (Brown, Fishco, & Hanna, 1993). It was expected that results on the MA test would be positively correlated with the vocabulary and reading comprehension tests, in support of Anglin's view (1993) that morphological skill contributes to a large portion of vocabulary growth.

As a third step, the participants were also given a multiple-choice vocabulary test using the same list of complex words. This allowed the testing of another type of metalinguistic skill, the ability to recognize whether or not a word is known. This form of 'knowing what you know' was termed accuracy.

In summary, the test designed for this study asked three questions for each of 50 complex words: (1) Do you know the word? (2) Do you know the morphologically simpler word? (3) Do you know the meaning? In addition to knowing its meaning, knowledge of a complex word should include the word's place in a word family, and measuring this type of MA was the primary purpose of the test design.

Hypotheses

Measuring MA required a means to tap awareness of knowledge that is normally implicit. Since this ultimate goal depended on the validity of the individual steps in the testing process, the hypotheses included predictions about separate sections of the morphology test. Most of the hypotheses involve comparing scores on the 3-part morphology test with scores on the Nelson-Denny Reading Test (ND). The first two hypotheses refer to part two of the morphology test which measures basic morphology skill (without measuring awareness of this knowledge):

1. Students with higher ND vocabulary scores would have better morphology skill than those with weaker vocabularies.

2. Students with better ND reading comprehension would have better knowledge of morphology than students with lower comprehension scores.

Hypotheses 3 and 4 refer to the measure of MA that is derived from the first and second test sections:

3. Students with higher ND vocabulary scores would have higher MA scores.

4. Students with higher ND reading comprehension scores would have higher MA scores.

The fifth hypothesis addresses the issue of transparency in word relationships:

5. On the morphology test, scores would be higher for complex words that retain the base word without changes of spelling or phonology (or with very minor changes).

The final hypothesis involves accuracy, another metalinguistic skill. It was predicted that:

6. Students with higher ND vocabulary scores would be more accurate at gauging their knowledge of word meanings than students with lower vocabulary scores.

CHAPTER 3
METHOD

Participants

Undergraduate students in psychology courses at the University of Florida were recruited for the study, and participation contributed to the fulfillment of course requirements. There were originally 108 participants, but 2 people were dropped from the analyses due to missing data. (One had to leave the test early and one skipped a page of the test.) Of the remaining 106 participants, there were 25 males and 81 females, and most were between 19 and 21 years old (M = 20.42; SD = 1.64). The majority reported that they spoke and read English fluently, with 80.2% speaking only English, and 84.0% reading only English. (Table 3-1). Of the other language use categories, the next highest percentages were for those who spoke both English and Spanish fluently (12.3%), and those who read fluently in both English and Spanish (8.5%).

Instruments

A Standardized Reading Test: The Nelson-Denny Reading Test

The Nelson-Denny Reading Test (ND) was selected as a standardized test because it is suitable for group administration and it provides norms for college students. The ND is a well-regarded instrument used both for research purposes and for assessment of reading progress in schools and in clinical settings (Masterson & Hayes, 2004), and Form G was used in this study. Standardization of the test was done from 1991 to 1992, and the college-level sample included over 5,000 students from 38 four-year universities (Brown, Fishco, & Hannah, 1993). Standard administration includes a 15-minute vocabulary section with 80 items, and a 20-minute comprehension section with 38 questions. Each multiple-choice question in the vocabulary and comprehension sections has five answer choices. As part of the comprehension test, at the end of the first minute, participants are instructed to mark the number at the end of the line they are

reading, and this provides the reading rate. The ND provides scores for vocabulary and reading comprehension, plus a combined score and the measure of reading rate.

The Morphology Test Designed for the Current Study

The test for measuring morphology skill contained three sections, which were called Subtest 1: Checklist, Subtest 2: Morphology Skill, and Subtest 3: Definitions. Each section required a response to the same list of 50 morphologically complex words. (Appendix A.) The items on the list ranged from fairly common words (*apparently, dependable,* and *expensive*) to words of low frequency (*impiety, indefatigable,* and *redacting*). Some of the words did not appear even one time in the WFB (Carroll, Davies, & Richman, 1971), so it can be assumed that their frequencies were extremely low. To the degree that word frequencies could be determined in the WFB, complex words were chosen that are much less frequent than the simpler words. (In English, there are a few complex words that occur more frequently than their base words, and these would not be suitable for this measurement of MA.) Compound words had to be avoided to prevent ambiguity in selecting a base word. The primary challenge in selecting test words was to find complex words containing two smaller words that would be plausible answer choices (aside from the correct answer), as in these examples:

noncombatant	a. comb	b. bat	c. combat
diversification	a. diverse	b. versify	c. diver

For Subtest 1: Checklist, participants were given the list of 50 complex words, and asked to place a check next to the words they know. The instructions included "check **yes** if you could use the word in a sentence." In everyday parlance, *knowing a word* means recognizing its meaning, and the superficial purpose of Subtest 1 was simply to obtain a yes-or-no response for this level of knowing each word. The less obvious purpose was to gain access to a deeper level of knowledge in later steps of the test. A thorough knowledge of a word includes its associations

with derivationally-related words. This knowledge is usually implicit, but can be made explicit by the sequence of Subtest 1: Checklist followed by the second subtest.

In Subtest 2: Morphology Skill, the participants were asked to identify the simpler word that is morphologically related to each of the complex words (as shown in the example above). By itself, the score for Subtest 2 would represent the student's basic knowledge of general derivational word-formation processes (or morphology skill). Taking results on Subtest 2 for only the words marked *known* on Subtest 1 represents the specific, usually tacit knowledge of the derivational relationships of the particular test words. This is how the score for morphological awareness (MA) was obtained.

Subtest 3: Definitions was a standard-format, multiple-choice vocabulary test, in which the definition of the target word had to be selected. A sample item from the third subtest was

42. demotion
    a. lowering of rank
    b. fluttering
    c. without moving

The score for Subtest 3: Definitions is simply a measure of knowledge of word meanings. Comparing Subtest 3 answers to words marked as known on Subtest 1 can be used as an assessment of metacognitive skill. This comparison was termed Accuracy because it indicates whether or not the students actually know the meanings of the words they think they know.

In addition to the three-part morphology test, the participants were also asked about the amount of reading they do, and if they had any language problems in school or difficulty learning a foreign language.

Scoring

Scores on the ND were obtained in accordance with the instructions in the test manual. The numbers of correct items on the Vocabulary and Comprehension tests were recorded, and these

were subsequently translated to raw scores, and then to standardized scores. Percentile ranks for each student were also obtained.

For the morphology test, three subtest scores were obtained. Starting with Subtest 1: Checklist, the number of words checked as known was recorded. Scores for Subtest 2: Morphology Skill, and Subtest 3: Definitions were the numbers of correct responses on each subtest. The responses to individual words on the three subtests allowed the scores for MA and accuracy to be derived. (Figure 3-1.)

The MA score was calculated by counting the correct answers from Subtest 2: Morphology Skill for words checked as known (on Subtest 1: Checklist). Similarly, Accuracy scores were obtained by assigning one point for each correct definition from Subtest 3: Definitions for each word checked as known (on Subtest 1: Checklist). As an example, if a student marked *commendable* as unknown on the Checklist, but correctly chose *commend* as the related word on Subtest 2: Morphology Skill, the student would be credited with one point toward the Subtest 2 score, but would not earn credit for this word on the MA score. Using the same procedures, if a student marked *opacity* as known, but did not select the correct definition on Subtest 3: Definitions, no point would be credited to the Accuracy score.

Procedure

Testing was done in groups, and the session took about one hour. After giving informed consent, the participants provided some demographic information and answered questions about their language and reading backgrounds. The ND was administered next, followed by the three subtests. Students had to complete the three sections in order, without returning to previous sections. Subtest 2: Morphology Skill included a timed measure and all participants started this section at the same time. After 3 minutes, the students were instructed to circle the number of the

last item completed, and they were then given as much time as needed to complete this section (usually just a minute or two).

Table 3-1. Languages participants use fluently.

	Speech	Reading
English only	85 (80.2%)	89 (84.0%)
English and Spanish	13 (12.3%)	9 (8.5%)
English and other	6 (5.7%)	3 (2.8%)

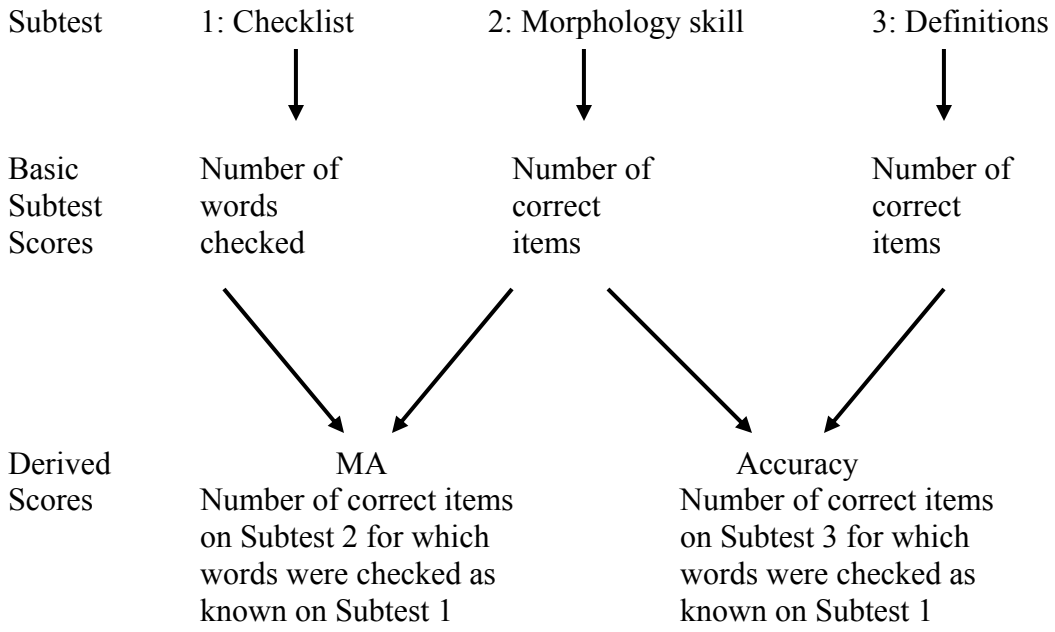

Figure 3-1. Scoring of the morphology test.

CHAPTER 4
RESULTS

The Nelson-Denny Vocabulary, Comprehension, and Total Reading scores were compared by grade level, and the four groups (freshmen through seniors) did not differ significantly. Also, there were no grade level differences for the morphology test scores, so grade level was not used in subsequent analyses, except for determining the percentile rank for each student according to the ND norms. A comparison of the Spanish/English bilingual students and the monolingual English-speaking students also found no correlations between language fluency and reading test scores.

No gender differences were found in the ND raw scores for Vocabulary, Comprehension, or Total Reading. The scores for the morphology test did not differ by gender, although the tests for differences on the MA and Subtest 1: Checklist scores approached significance, with p values of 0.052 and 0.054. In both of these cases, the average score of the male students was higher than for the female students. In light of the relatively large number of comparisons, and the lack of differences on the standardized test, gender was not considered in further analyses.

Amount of Reading

Roughly 76% of the students reported reading less than 4 hours per week for fun, and about 74% claimed that time spent reading for class was less than 8 hours per week (Table 4-1). Most students (about 67%) reported that during a year they read 5 or fewer books for fun. Only 17% indicated that they chose to read more than 10 books in a year. Correlations were run between the amount of reading and the ND and morphology test scores, but no significant correlations were found.

Participants' Reading Background

In questions about their reading background, a small proportion of students described learning difficulties that had been identified or for which they received tutoring. These included speech therapy (7.5%), a reading problem (2.8%), and learning difficulty (2.8%). None of the students reported any other type of language problems that had been formally identified. Another set of questions asked about problems they may have noticed, but that were never diagnosed. In this section, 11 students said they noticed a spelling problem (10.4%), and 5 reported a language difficulty (4.7%). This line of questioning was intended to pick up additional reading problems, but there may have been some misunderstanding. Two students indicated both an identified reading problem, and a reading problem that they noticed but that was not formally recognized. While it is possible that they might have two separate reading problems, it is more likely these two answers represent a duplication. Counting these 2 students only once for the identified problem, there were 8 students (7.5 %) who thought they had reading problems that had not been diagnosed. Another 10 students reported trouble learning a foreign language. A learning difficulty in a family member was reported by 15 students, and about half of these relatives were brothers, but the numbers in each category of family member were too small to make a valid comparison. About a third of the college students reported having received tutoring for some subject in the past, and the tutoring subjects very mostly math. Only 3 students (2.8%) were tutored in reading.

Due to the small number of students with learning problems, the problems were combined. For each student, one point was added for each affirmative answer to a question about a learning difficulty or a family member with a learning difficulty. This step resulted in 67 students (63.2%) reporting no learning problems, 25 students (23.6%) with one instance, and 14 students (13.2%) with between 2 and 5 various problems. Comparing the total number of learning problems and

gender, the means for the female and the male students did not differ. Correlations were run between the total problems and the ND and morphology test scores, and no correlations were found.

Individual Tests

Nelson-Denny Reading Test

The ND test yielded raw scores for Vocabulary, Comprehension, Total, and reading rate, and these scores are shown in Table 4-2. For the Vocabulary and Comprehension tests, participants from the University of Florida on average, had reading skills higher than those in the ND standardization sample, particularly among the freshmen, sophomores, and juniors. The average scores of the seniors were very close to the ND norms. The average reading rates for the study participants were below the ND norms.

Morphology Test: Subtests 1, 2, and 3

On Subtest 1: Checklist, participants indicated that they knew most of the 50 words. For Subtest 2: Morphology Skill, and Subtest 3: Definitions, most of the items were answered correctly. A timed measure on Subtest 2: Morphology Skill provided the number of items completed in 3 minutes. These scores are shown in Table 4-3.

The derived scores, MA and Accuracy, were calculated from the three subtests, and these are also shown in Table 4-3. These scores for metacognitive skills show that for words they claimed to know, students correctly picked the morphologically-related word for about 39 of the 50 words, and identified the definition for about 40 words.

Correlations between the three Subtest scores, the two metalinguistic scores, and the ND raw scores are shown in Table 4-4, and all were significant ($p < .05$). The correlations of greatest interest were those between the main scores of the ND (Vocabulary, Comprehension, and Total), and the morphology tests devised for this study.

The correlations of Subtest 2: Morphology Skill and the ND Vocabulary and Comprehension scores were used to test hypotheses 1 and 2. These hypotheses were that:

1. Students with higher ND vocabulary scores would have better morphology skill than those with weaker vocabularies.

2. Students with better ND reading comprehension would have better knowledge of morphology than students with lower comprehension scores.

These correlations were positive and significant, but not very large ($r = .43$ for Morphology and ND Vocabulary; $r = .27$ for Morphology and ND Comprehension), but the results did support the hypotheses.

Hypotheses 3 and 4 were

3. Students with higher ND vocabulary scores would have higher MA scores.

4. Students with higher ND reading comprehension scores would have higher MA scores.

The correlation of MA and the ND Vocabulary scores was .64, and the correlation of MA and ND Comprehension scores was .45, so hypotheses 3 and 4 were supported by the results.

The ND vocabulary scores were compared with the Accuracy scores for the sixth hypothesis:

6. Students with higher ND vocabulary scores would be more accurate at gauging their knowledge of word meanings than students with lower vocabulary scores.

The result was $r = .65$ for Accuracy and ND Vocabulary, which supports hypothesis 6. In addition, a correlation of $r = .52$ was found for Accuracy and ND Comprehension. (Hypothesis 5 will be discussed below.)

The strongest correlations were between the ND scores and Subtest 3: Definitions, ranging from .63 to .73. The measures for Subtest 1: Checklist, Subtest 2: Morphology Skill, and the timed 3-minute score showed weak to modest correlations with the ND scores ($.27 < r < .49$).

To further investigate the MA scores, the number of errors across all participants was calculated for each item on Subtest 2: Morphology Skill. The 50 words were split in half, and assigned to one of two categories: easy words (0 to 3 errors), and hard words (4 to 77 errors). Correlations were run for the 25 harder items and the ND scores, which produced slightly higher correlations for ND Comprehension and Total scores, but no change in the correlation with the ND Vocabulary test. (Table 4-5.)

In a standard linear regression analysis, three variables, MA, Subtest 2: Morphology Skill score, and Subtest 3: Definitions score, were tested as predictors of the ND Total Reading score. Combined, the three independent variables accounted for over half ($R^2 = .543$) of the variability in the ND Total Reading scores, although the separate contributions of the morphology and MA scores were not significant. The score for Subtest 3: Definitions was the best predictor of the ND Total Reading score, as shown in Table 4-6.

Hypothesis 5 was related to transparency of word relationships:

5. On the morphology test, scores would be higher for complex words that retain the base word without changes of spelling or phonology (or with very minor changes).

To test hypothesis 5, the relationship of each complex word to its base word was assessed to indicate the degree of transparency (or opacity) of the relationship. This was quantified by counting the number of spelling and phonological changes between the two words. As an example, the word *protestation* contains an intact base word, *protest*, and there are no phonological changes to the base word inside the complex word, so it was scored as 0 changes. The changes to the word *decide* in *indecision* are more numerous: 2 letters of *decide* are deleted, the vowel *i* changes from a long to short sound, and the consonant after the *i* changes, so this was counted as 4 changes. In examining the number of changes and the number of errors for each of the 50 word pairs, no correlation was found.

Self-assessment of Reading and Vocabulary

The participants were asked to rate their own reading skill and vocabulary knowledge, and the vast majority reported that their skills are at least adequate for the demands of college-level reading. Only 3 students reported less-than-adequate vocabulary, and only 4 thought their reading skills were insufficient. One of these students rated both her vocabulary and reading skill as low, but the other 6 indicated low skill in only one category. For the 3 claiming low vocabulary skill, percentile ranks on the ND Vocabulary test were between 6 and 27 percent. For the remaining 3 who rated their reading skills as low, only one seemed to be accurate, with a percentile rank lower than 10%. The other two students had percentile ranks between 40 and 80% on the ND tests. Using the ND percentile ranks, the number of students in each quartile was examined, as shown in Table 4-7. For the Vocabulary, Comprehension, and Total Reading scores, all but 16 to 18 students (15 - 18%) were above the lowest quartile, confirming that the level of reading skill for most students should be adequate.

Comparison of Better and Less-skilled Readers

Using the percentile ranks of the ND Total Reading scores, participants were divided into two groups of reading ability, those in the lower half and those ranked at 51% or above. Using an ANOVA, the means for the two groups were then compared on four aspects of the morphology test: Subtest 2: Morphology Skill, Subtest 3: Test of Definitions, the timed measure of morphology skill, and MA. (Table 4-8.) For all 4 measures, the means of the two groups were significantly different with higher means for the group of better readers. On all four tests, the difference in means between groups was significant ($p < .01$).

Table 4-1. Amount of reading per week during the school semester.

	Purpose of reading	
	For fun Number (Percent)	For class Number (Percent)
Less than 2 hours	54 (51%)	8 (8%)
More than 2 hours, but less than 4 hours	26 (25%)	32 (30%)
More than 4 hours, but less than 6 hours	9 (9%)	25 (24%)
More than 6 hours, but less than 8 hours	8 (8%)	13 (12%)
More than 8 hours, but less than 10 hours	3 (3%)	7 (6%)
More than 10 hours	5 (5%)	21 (20%)

Table 4-2. Nelson-Denny Reading Test scores for the standardization sample and University of Florida students.

	Standardization sample		University of Florida	
	Mean	SD	Mean	SD
Freshmen				
Vocabulary	52.43	15.12	55.33	7.37
Comprehension	51.73	15.19	59.33	14.19
Total	103.45	28.78	114.67	21.50
Reading rate	238.46	87.03	207.33	21.36
Sophomores				
Vocabulary	58.70	14.30	60.09	12.46
Comprehension	55.57	14.59	58.82	14.30
Total	113.94	27.03	117.55	25.63
Reading rate	246.81	85.54	218.05	50.78
Juniors				
Vocabulary	61.21	13.47	65.86	9.62
Comprehension	57.28	14.15	62.34	11.45
Total	118.72	25.74	128.20	19.28
Reading rate	251.91	83.77	242.59	68.86
Seniors				
Vocabulary	64.52	11.46	64.89	9.68
Comprehension	61.60	11.94	62.52	9.23
Total	126.56	21.91	126.98	17.12
Reading rate	257.65	83.03	240.75	78.08

Note: There were 106 participants from the University of Florida (3 freshmen, 22 sophomores, 35 juniors, and 46 seniors). The Nelson-Denny standardization sample included 1,043 freshmen, 488 sophomores, 584 juniors, and 558 seniors. The Nelson-Denny data are from Brown, J. I., Fishco, V. V., & Hanna, G. S. (1993). *Nelson-Denny Reading Test*: *Technical Report Forms G & H*. Itasca, IL: Riverside Publishing.

Table 4-3. Performance on morphology test subtests and metalinguistic measures (n = 106).

	Mean	SD	Range[a]
Subtest 1: Checklist	42.14	4.34	26 - 49
Subtest 2: Morphology skill	45.05	4.18	23 - 50
Subtest 3: Definitions	45.73	3.70	33 – 50
3-minute score, Subtest 2	43.66	7.76	18 – 50
MA (Morphological awareness)	38.99	5.11	24 - 49
Accuracy	39.92	5.13	22 - 49

[a]maximum possible score = 50

Table 4-4. Intercorrelations among measures.

	1 MA	2 Accuracy	3 Subtest 1 checklist	4 Subtest 2 morphology skill	5 Subtest 3 definitions	6 3-minute timed measure	7 ND vocabulary	8 ND comprehension	9 ND total
1.	-	.							
2.	.886**	-	.						
3.	.814**	.889**	-						
4.	.706**	.390**	.212*	-					
5.	.694**	.762**	.460**	.484**	-				
6.	.445**	.357**	.234*	.428**	.461**	-			
7.	.642**	.649**	.468**	.434**	.723**	.490**	-		
8.	.448**	.518**	.330**	.272**	.628**	.299**	.697**	-	
9.	.603**	.638**	.448**	.372**	.726**	.415**	.910**	.905**	-

Note: *$p < 0.05$; **$p < 0.01$

Table 4-5. Correlations of Nelson-Denny and MA (Total and hard words) scores.

	Nelson-Denny Reading Test		
	Vocabulary	Comprehension	Total
MA Total (50 words)	.642	.448	.603
MA Hard words (25 words)	.642	.496	.634

All were significant at the $p < .01$ level.

Table 4-6. Linear regression predicting Nelson-Denny Total Reading (raw scores) from three predictor variables.

Variable	Standardized coefficients Beta	t-value
Subtest 3: Definitions	.584	6.04*
Subtest 2: Morphology skill	.022	0.22
MA	.182	1.71

*$p < 0.001$

Table 4-7. Performance of good and less-able readers

Score	Mean scores by group		F statistic	p value
	1 – 50 percentile	51-100 percentile		
Subtest 2: Morphology skill	43.78	45.98	7.68	.007
Subtest 3: Definitions	43.82	47.13	25.52	.000
3-minute Morphology measure	39.93	46.41	21.59	.000
MA	37.11	40.36	11.66	.001

Table 4-8. Numbers and percentages of participants in each quartile of Nelson-Denny scores.

	Quartile			
	First No. (Percent)	Second No. (Percent)	Third No. (Percent)	Fourth No. (Percent)
Vocabulary	16 (15.1%)	27 (25.5%)	38 (35.8%)	25 (23.6%)
Comprehnsn.	18 (17.0%)	28 (26.4%)	30 (28.3%)	30 (28.3%)
Total reading	16 (15.1%)	29 (27.4%)	33 (31.1%)	28 (26.4%)
Reading rate	37 (34.9%)	28 (26.4%)	27 (25.5%)	14 (13.2%)

CHAPTER 5
DISCUSSION

Findings of the Current Study

The goals of the current study were to develop a measure of MA in young adult readers and to examine its association with reading ability, and in particular, vocabulary skill. While there are many strategies children and adults use to acquire new vocabulary, morphological knowledge may be particularly important for later vocabulary development as older children and adults encounter more complex reading material. There are many good reasons for expecting MA to be linked to reading ability in adults, but as yet, there is little empirical evidence. There has been only limited testing of MA in adults, especially in conjunction with standardized measures of reading skill, and this study represents an initial foray into this area. Overall, the results showed that better readers and those with strong vocabularies had better metalinguistic awareness than less-adept readers. The new method shows promise and deserves additional development.

The conceptual underpinning of this study assumes that there is a bidirectional relationship between MA and reading. The evidence that reading promotes MA is based largely on characteristics of the English language. The scope of words used in writing is much broader than the vocabulary of everyday conversation. Some understanding of morphology is gained through spoken language, but exposure to morphemes would be limited without extensive reading. It appears that reading would be essential to gaining MA in English, and by default, this leads to the corollary that reading must be the impetus that spurs morphological understanding.

The reasoning behind the second element—that MA promotes reading--is this: vocabulary knowledge contributes to reading comprehension, and morphology knowledge contributes to vocabulary. Also, awareness of one's knowledge (explicit knowledge) represents a deeper understanding than implicit skill. Therefore, an explicit knowledge of word formation principles, and the clues to meaning that result, should contribute to skilled reading.

These claims seem plausible, but the separate steps have not been fully tested. Vocabulary knowledge is closely tied to reading comprehension, and correlations between vocabulary and comprehension tests are often in the .80 range (Bloom, 1976, cited in Biemiller & Boote, 2006). Although reading comprehension requires more than vocabulary, knowledge of the words is certainly a major factor. As for the next step, the relationship of morphology to vocabulary has some empirical support, but this has not been widely investigated, and the studies are limited mostly to elementary and middle school students. Finally, although several studies have claimed to measure the specific awareness of morphology, the distinction between implicit and explicit knowledge is still fuzzy. The developmental progression of morphology skill has yet to be fully analyzed and described.

Two lines of reasoning suggest that MA should increase through the teenage years and into early adulthood. First, previous studies show that morphology knowledge is growing in middle school, but is far from complete. In addition, as students advance in school, the level of the reading material increases in difficulty. These two conditions set the stage for MA to increase through high school and early adulthood, (assuming that sufficient reading is done). The next logical step, and the primary goal of this study, was to study the development of MA in older students and adults by developing a new method of assessing MA.

To evaluate the new method, the various elements of the morphology test were compared to the results on the Nelson-Denny (ND), a standardized reading test. The first two hypotheses were that the scores on tests of Morphology Skill (Subtest 2) would be correlated with the ND Vocabulary and Comprehension scores. The results supported these hypotheses, although the correlations were modest. The Morphology Skill scores were more highly correlated with the ND Vocabulary scores than with the Comprehension scores, as would be predicted from the role that morphology is thought to play in reading. These results also reflect the fact that reading comprehension requires an array of skills, and not just word knowledge.

The next two hypotheses stated the key predictions of the study—that the MA measure would be related to the ND Vocabulary and Comprehension scores, and these hypotheses were confirmed by fairly strong correlations. Again, the correlation of the experimental measure for MA was more strongly related to Vocabulary than to Comprehension. Also, the correlations involving the derived MA score were higher than those using the basic Morphology Skill score, which lends support to the concept of measuring explicit knowledge of morphology as opposed to a basic, implicit level of morphology skill. The data suggest that this test of MA taps an ability that is closely related to the knowledge of word meanings.

The fifth hypothesis was based on results from previous studies, and it predicted that transparent word relationships would show higher scores on Morphology Skill (Subtest 2). In most studies of MA, the degree of transparency of word relationships has influenced the MA scores, because phonological and spelling changes can mask the relationship between base word and derived forms or make the similarities readily apparent. For example, phonology has an influence in that young readers are more likely to recognize the relationship of *culture* to *cultural* than of *nature* to *natural*. Fewer changes make the relationship of *happy* to *happiness* easier to see than the relationship of *pronounce* to *pronunciation*, but the influence of phonological changes compared to spelling changes is difficult to assess. Previous studies have evaluated transparency in a variety of ways, and there is no clear-cut method for rating the transparency or opacity of word relationships. For the adult readers in this study, however, the transparency of the word relationships did not seem to be a factor. This is likely due to the familiarity of the words to the participants, but it would also reflect the higher levels of MA possessed by these older readers in comparison to studies of younger students.

The final hypothesis was that students with better vocabulary skill, as measured by the ND, would also be more accurate at assessing their knowledge of individual words, and results supported this hypothesis. The validity of self-ratings of word knowledge (or the ratings of parents

of their children's vocabulary) has been a methodological issue in language research, but this type of measure also has applications for instructional design and curriculum planning. If students are wrong in thinking their word knowledge is sufficient, they may not make an effort to improve. Evaluating this metacognitive aspect of vocabulary would be useful due to its implications for reading and vocabulary instruction.

Correlations were also examined between the scores on Subtest 3: Definitions and the ND scores. The third subtest was a basic test of knowing the meanings of words, and it used a format that is typical for a vocabulary test. The relatively strong correlations may reflect the greater familiarity of a multiple-choice vocabulary exercise, better-designed test items, or some combination of factors. If the element of the test measuring basic vocabulary skill had not been positively related to the ND Vocabulary scores, the value of the test would be seriously undermined. The large correlation between the ND Vocabulary test and Subtest 3: Definitions affirms that this aspect of the morphology test is at least 'in the ballpark.'

While five of the six hypotheses were supported, there were also some unexpected results in the study. It was predicted that the reported amounts of reading would be positively correlated with the scores on the ND and on the morphology test, but this was not the case. Surprisingly, no relationships between amounts of reading and test scores were found. It is possible that the question about time spent reading for class was interpreted to mean literally reading a textbook and that this did not include reading notes or other studying. It is also possible that reading skill was developed prior to college entry, and that current reading habits are not related to reading ability, although the norms for the ND test do not fully bear out this idea because they show increases in vocabulary and comprehension scores during the four years of college. More detailed questions about reading habits may have been needed.

The biggest limitation of the study is related to its level of difficulty, because the test turned out to be relatively easy for most of the participants. As a group, the students who participated

were better-than-average readers. Their ND Vocabulary, Comprehension, and Total scores were above the norms for each year of education. The fact that these participants were almost uniformly good readers probably contributed to a ceiling effect in the results of this study. For a sample of highly competent readers, it would have been better to include more difficult test items. Of the 50 complex words tested in this study, most were familiar to the participants, with an average of 42 words checked as *known*. The third subtest showed that the participants could pick the correct definition for almost 46 of the 50 words, so very few of the items were unfamiliar. More obscure and complex words could be included in future versions of the test, although there is little information available about levels of difficulty in this type of word knowledge.

In questions about their reading and education history, few of the participants noted that they had ever experienced problems in reading. This is another indication of the high level of relevant skills in this sample. The incidence of reading disability or dyslexia in the overall population has been reported as between 5 and 17.5% (Shaywitz & Shaywitz, 2003; Katusic, Colligan, Barbaresi, & Schaid, 2001), depending on the definition and the diagnostic criteria used. Of the college students who participated in the present study, only 3 (2.8%) reported having received tutoring in reading, although 9 (7.5%) had received speech therapy and more suspected that they might have had some difficulties in learning language. It is possible that students who have experienced reading difficulties might be less likely to be admitted to a top-ranked state university than students without reading problems. No correlation was found between the history of reading problems or learning disabilities and the ND scores, and this was probably due to the sample size in this study. If an average of 10% of a population is dyslexic, then a much larger sample should be used to investigate the morphological skills of students with reading difficulties.

Based on these results, the mechanics of the morphology test seem sound, but a wider scope of test items is needed. Including more obscure words could extend the upper range of the test. The multiple-choice format can create a more challenging test than the ‘comes from’ test, and the

main problem is finding suitable items to test. The current test used only free stems (whole words) as answer choices, but using more distantly-related members of word families could increase the difficulty. Recognizing words with bound stems in common (such as *transmittal* and *admission,* or *scribble* and *nondescript*) is more challenging than noticing shared free stems (as in *readmission* and *admit*). Such items could measure a more abstract level of morphological skill.

Reasons to Pursue Morphological Awareness Research

In spite of the high stakes involved in teaching children to read, MA has been almost overlooked by many reading researchers. With the increasing attention being given to reading problems of older students, morphological awareness (MA) warrants closer investigation. Even though a deficiency in morphology skill may not be apparent in young students, the full developmental course of morphological knowledge needs more study.

Several studies have examined both PA and MA in young readers, and PA has retained its crown as the key element in learning to read, with MA making a much smaller contribution (McBride-Chang, Wagner, Muse, Chow, & Shu, 2005; Nagy et al., 2006; Mahony, Singson, & Mann, 2000). Still, it is difficult to completely disentangle PA from MA, and these skills have a fair amount of overlap (McBride-Chang, et al., 2005). For example, the classic elision test leads off with easier questions such as 'Can you say *popcorn* without the *pop*?' The *pop* can be labeled a phonemic unit at the level of the syllable, but it is also a morpheme. It may be that MA helps children to isolate phonemes in the speech stream, and that early morphological skill has been subsumed by some PA tasks. Although in learning to read, the critical nature of PA seems unequivocal, these results do not mean that MA is unimportant for more advanced reading. Without well-defined tasks for measuring MA and tasks that are appropriate for older readers, it is difficult to completely disentangle the PA and MA components of reading and to organize them in a chronological pattern of development.

While explicit awareness of morphology is presumed to be valuable, this assumption seems based on an analogy to PA, rather than on empirical evidence. Interest in MA is growing, but research in this area is still relatively sparse. Some organizational frameworks for morphology and MA knowledge have been proposed, but to date, there is no complete analysis or delineation of these skills. One contribution of the present study is that it describes a method for eliciting knowledge about specific complex derivational words. This method makes explicit some word knowledge that may normally remain implicit, and this provides a measure of MA that is distinct from the measure of basic morphological skill.

Morphological knowledge is valuable to all readers, but better measures of the skill could be helpful in identifying and remediating reading problems. There are few published studies on dyslexia and morphology skill, and the results are not definitive. Several causes of dyslexia have been put forward, but the prime suspect is a phonological deficit. To some extent, it seems that a phonological deficit impedes the development of morphology skill (Carlisle, 1987), but it has also been suggested that dyslexics may use some types of morphemic information to compensate (Casalis, Colé, & Sopo, 2004). Morphemes are usually larger than phonemes and may be an easier unit to discern in ongoing speech. On the other hand, morphemes represent a more abstract level of language than either words or phonemes. In school, there is explicit instruction in letter-sound pairings and in writing words, but there is much less emphasis on morphemes. It is possible that dyslexic students derive their knowledge of morphemes from spoken language, and use this level to compensate for impaired phonemic skills.

Most children master inflectional morphology in the first few years of life, using oral language. Some derivational morphology is learned from speech, but the most extensive experience is gained from reading. It would be expected that adult dyslexic readers would have acquired the basics of word morphology, but that advanced levels of skill would be more elusive in this group. It would be useful to examine the abilities of adolescent and adult dyslexics to better

understand the clues they utilize in gaining meaning from print. This would require a finely calibrated test that assesses a clear continuum of morphology skills--another argument for a morphology test of adult levels of skill.

The US education system has been criticized for its approach to vocabulary, and the approach seems to be that students are on their own. One education researcher has pointed out that everything needed for mathematics is taught in math classes, but that when it comes to vocabulary, students must bring their own word knowledge (Becker, 1977). Children who enter school with limited vocabularies tend to stay behind in vocabulary skill. This deficit interferes with reading and can have a detrimental effect on learning in every academic subject. With the enormous hurdles faced by educators, it is unlikely that vocabulary would be added to the curriculum as an additional subject, but promoting MA might be feasible. By calling attention to word relationships, educated adults can guide students in the recognition of morphological relationships. The fostering of these word analysis skills would give students another tool to use for building their lexicons.

Rarely taught and usually learned implicitly, morphology is beginning to receive more attention from reading researchers. Reading comprehension requires the fluent, efficient recognition of words and their meanings, and morphology is surely crucial to this process. Knowing a word involves more than knowing its definition, and a competent reader must recognize how a complex word is related to other words. There are countless tests of word meaning, but there is no standard gauge of word difficulty in terms of morphology, and no test of this type of knowledge for adult readers. A battery of reading tests typically measures vocabulary, syntax, and comprehension skills. Morphology is interrelated with all 3 areas, and a single, relatively short test of MA might allow a quick assessment of the elements that link sounds to meaning.

Similarly, accuracy in the self-assessment of vocabulary knowledge would influence one's approach to reading. Measuring these metalinguistic skills is important for both theoretical and practical reasons. While the role of PA in learning to read is essentially indisputable, the contributions of other metalinguistic skills have been proposed. Being able to assess these skills in adult readers would fill a gap in the research. From a pragmatic point of view, having a quick test of these skills could help reading teachers pinpoint the particular weaknesses of struggling adult readers. This study provides one step toward better measurement of these important skills.

APPENDIX: MORPHOLOGY TEST

INSTRUCTIONS: Please check the most appropriate answer for each question.

Language use

1. What languages do you speak fluently?

_____ English
_____ Spanish
_____ Other [please list]:

2. In what languages do you read fluently?

_____ English
_____ Spanish
_____ Other [please list]:

Current reading and vocabulary levels

3. During a school semester, how many hours do you spend each week reading for pleasure?

_____ Less than 2 hours
_____ More than 2 hours, but less than 4 hours
_____ More than 4 hours, but less than 6 hours
_____ More than 6 hours, but less than 8 hours
_____ More than 8 hours, but less than 10 hours
_____ More than 10 hours

4. During a school semester, how many hours do you spend each week reading for classes?

_____ Less than 2 hours
_____ More than 2 hours, but less than 4 hours
_____ More than 4 hours, but less than 6 hours
_____ More than 6 hours, but less than 8 hours
_____ More than 8 hours, but less than 10 hours
_____ More than 10 hours

5. In a year, how many books do you read for pleasure?

_____ 0 - 5
_____ 6 - 10
_____ 11- 20
_____ more than 20

6. Do you think your vocabulary knowledge is adequate for college courses?

_____ My vocabulary knowledge is more than adequate for college courses.
_____ My vocabulary knowledge is adequate for college courses.
_____ My vocabulary knowledge is not adequate for college courses.

7. Do you think your reading ability is adequate for college courses?

_____ My reading ability is more than adequate for college courses.
_____ My reading ability is adequate for college courses.
_____ My reading ability is not adequate for college courses.

Language and reading background

The questions below in #8 refer to difficulties that may have been formally identified through special services or other testing. If you check *Yes* for any of the following questions, please explain below.

8. In your native language, have you ever:

had speech therapy?	____Yes	____No
had a reading problem identified?	____Yes	____No
had any other language problem identified?	____Yes	____No
received a diagnosis of a learning difficulty?	____Yes	____No
been tutored due to difficulty in school?	____Yes	____No

If yes, in what areas have you had tutoring? ____reading ____math ____other*

The questions below in #9 refer to problems that you may have noticed, but that were not formally identified.

9. In your native language, have you ever:

had problems with reading?	____Yes	____No
had problems with spelling?	____Yes	____No
had any other problems with language?	____Yes	____No

10. Have you had more than average difficulty learning a foreign language? ___Yes ____No

11. Does anyone in your immediate family have a learning difficulty? ____Yes ____No

If yes, who? ____Mother ____Father ____brother/s ____sister/s

If you answered 'yes' to any parts of #8 through 11, please explain:

Demographic information

12. Age: ____17 ____18 ____19 ____ 20 ____ 21 ____ 22 ____other: _____

13. Sex: ____Female ____Male

14. Current designation: ____ Freshman ____ Sophomore ____ Junior ____ Senior ____other

Part 1: Look at each word in the list below. Check ***yes*** if you know the word. Check ***no*** if you do not know the word. (If you are unsure, check **yes** if you could use the word in a sentence.)

Do you know the word?

Example	**teacher**	__√__Yes	_____ No
Example	**thorfelize**	_____Yes	___√_ No

1. **noncombatant** _____Yes _____ No
2. **mistreating** _____Yes _____ No
3. **allegorical** _____Yes _____ No
4. **believable** _____Yes _____ No
5. **discredited** _____Yes _____ No
6. **unmitigated** _____Yes _____ No
7. **correspondence** _____Yes _____ No
8. **decadence** _____Yes _____ No
9. **hypothetically** _____Yes _____ No
10. **explanatory** _____Yes _____ No
11. **impiety** _____Yes _____ No
12. **presumptuous** _____Yes _____ No
13. **readmission** _____Yes _____ No
14. **indefatigable** _____Yes _____ No
15. **bedevilment** _____Yes _____ No
16. **diversification** _____Yes _____ No
17. **enduring** _____Yes _____ No
18. **detestable** _____Yes _____ No
19. **reciprocity** _____Yes _____ No
20. **commendable** _____Yes _____ No
21. **irreverent** _____Yes _____ No
22. **provocation** _____Yes _____ No
23. **despicable** _____Yes _____ No
24. **expensive** _____Yes _____ No
25. **protestation** _____Yes _____ No
26. **licensure** _____Yes _____ No
27. **despotism** _____Yes _____ No
28. **incomparable** _____Yes _____ No
29. **apparently** _____Yes _____ No
30. **fundamental** _____Yes _____ No
31. **liberation** _____Yes _____ No
32. **demolition** _____Yes _____ No
33. **improvisational** _____Yes _____ No
34. **contender** _____Yes _____ No
35. **redacting** _____Yes _____ No
36. **operationalize** _____Yes _____ No
37. **presentiment** _____Yes _____ No
38. **bravery** _____Yes _____ No
39. **indecision** _____Yes _____ No
40. **opacity** _____Yes _____ No
41. **incessant** _____Yes _____ No
42. **demotion** _____Yes _____ No
43. **indivisible** _____Yes _____ No
44. **dependable** _____Yes _____ No
45. **obliterating** _____Yes _____ No
46. **addressing** _____Yes _____ No
47. **coordination** _____Yes _____ No
48. **discovery** _____Yes _____ No
49. **placidity** _____Yes _____ No
50. **defamation** _____Yes _____ No

Part 2: In each line, the word in **bold** font was formed from one of the words on the right. Select the letter of the word on the right which is the basis for the **bold** word.

Examples:

__c__ **teacher**	a. tea	b. each	c. teach
__a__ **undamaged**	a. damage	b. dam	c. aged

_____ 1. **noncombatant**	a. comb	b. bat	c. combat
_____ 2. **mistreating**	a. mist	b. treat	c. eating
_____ 3. **allegorical**	a. all	b. leg	c. allegory
_____ 4. **believable**	a. belief	b. belie	c. lie
_____ 5. **discredited**	a. disc	b. credit	c. edited
_____ 6, **unmitigated**	a. mit	b. gate	c. mitigate
_____ 7. **correspondence**	a. respond	b. dense	c. pond
_____ 8. **decadence**	a. decay	b. decade	c. cadence
_____ 9. **hypothetically**	a. hypothecary	b. thesis	c. the
_____ 10. **explanatory**	a. plane	b. planetary	c. explain
_____ 11. **impiety**	a. imp	b. pious	c. pie
_____ 12. **presumptuous**	a. presume	b. sump	c. sumptuous
_____ 13. **readmission**	a. read	b. admit	c. mission
_____ 14. **indefatigable**	a. fat	b. gable	c. fatigue
_____ 15. **bedevilment**	a. evil	b. bed	c. devil
_____ 16. **diversification**	a. diverse	b. versify	c. diver
_____ 17. **enduring**	a. ring	b. during	c. endure
_____ 18. **detestable**	a. stable	b. detest	c. testable
_____ 19. **reciprocity**	a. recipe	b. reciprocal	c. receipt
_____ 20. **commendable**	a. commend	b. mend	c. mendable
_____ 21. **irreverent**	a. reverse	b. revere	c. rent
_____ 22. **provocation**	a. prove	b. provoke	c. vocation
_____ 23. **despicable**	a. spice	b. cable	c. despise
_____ 24. **expensive**	a. expend	b. pensive	c. pens

_____ 25. **protestation**	a. station	b. testate	c. protest
_____ 26. **licensure**	a. censure	b. license	c. ensure
_____ 27. **despotism**	a. despot	b. spot	c. pot
_____ 28. **incomparable**	a. income	b. parable	c. compare
_____ 29. **apparently**	a. parent	b. rent	c. appear
_____ 30. **fundamental**	a. fun	b. mental	c. fundament
_____ 31. **liberation**	a. beration	b. liberate	c. ration
_____ 32. **demolition**	a. demo	b. mole	c. demolish
_____ 33. **improvisational**	a. improve	b. provide	c. improvise
_____ 34. **contender**	a. ender	b. contend	c. tend
_____ 35. **redacting**	a. red	b. redact	c. acting
_____ 36. **operationalize**	a. rationalize	b. opera	c. operate
_____ 37. **presentiment**	a. present	b. resentment	c. sentiment
_____ 38. **bravery**	a. raver	b. very	c. brave
_____ 39. **indecision**	a. incision	b. decide	c. indecent
_____ 40. **opacity**	a. opaque	b. pace	c. city
_____ 41. **incessant**	a. cess	b. ant	c. cease
_____ 42. **demotion**	a. demo	b. motion	c. demote
_____ 43. **reforestation**	a. station	b. forest	c. fore
_____ 44. **dependable**	a. depend	b. deepen	c. endable
_____ 45. **obliterating**	a. literate	b. rating	c. obliterate
_____ 46. **addressing**	a. dress	b. address	c. dressing
_____ 47. **coordination**	a. ordination	b. ordinal	c. coordinate
_____ 48. **discovery**	a. disco	b. cover	c. discover
_____ 49. **placidity**	a. acidity	b. placid	c. place
_____ 50. **defamation**	a. fame	b. famish	c. family

Part 3: Select the best definition for each word.

____1. noncombatant
a. someone in disguise
b. someone not fighting
c. someone with messy hair

____ 2. mistreating
a. behaving badly toward
b. clearing of foggy weather
c. unrecognizable food

____ 3. allegorical
a. happy
b. symbolic
c. knitted leg covering

____ 4. believable
a. in the realm of possibility
b. an unlikely story
c. able to survive a tragedy

____ 5. discredited
a. forced to pay with cash
b. a charge that is removed
c. proven false or worthless

____ 6. unmitigated
a. without a lawsuit
b. with one's bare hands
c. not toned down

____ 7. correspondence
a. exchange of letters; matching
b. organisms in a small pond
c. a legal document

____ 8. decadence
a. a 10-year period
b. declining, or self-indulgence
c. varying in pace

____ 9. hypothetically
a. with a needle
b. using supposition
c. written in ink

____ 10. explanatory
a. uneven; not flat
b. outside the solar system
c. giving reasons or causes

____ 11. impiety
a. elf-like, fairy tale character
b. lack of respect
c. baked in a round pan

____ 12. presumptuous
a. overly bold or confident
b. overly ornate
c. asking over and over

____ 13. readmission
a. place of refuge
b. tutoring in reading
c. entering again

____ 14. indefatigable
a. in civilian clothes
b. without tiring
c. never losing

____ 15. bedevilment
a. a lumpy mattress
b. causing trouble or distress
c. intense fear

____ 16. diversification
a. branching out
b. making into song
c. turning prose into poetry

____ 17. enduring
a. lasting
b. going on at the same time
c. changing rapidly

____ 18. detestable
a. causing hatred or dislike
b. cannot be measured
c. a horse out of the barn

____ 19. reciprocity
a. sharing cooking instructions
b. exchanging or sharing privileges
c. the part left over in division

____ 20. commendable
a. something that can be fixed
b. worthy of praise
c. something that can be sold

____ 21. irreverent
a. cannot be undone
b. going forward
c. lacking respect

____ 22. provocation
a. a first job
b. causing a response
c. a mathematical proof

____ 23. despicable
a. carefully chosen
b. food without seasoning
c. viewed with contempt

____ 24. expensive
a. talking too much
b. thoughtful
c. costly

____ 25. protestation
a. objecting to something
b. taking a practice test
c. an outdated train or bus depot

____ 26. licensure
a. formal granting of permission
b. making sure of something
c. blaming or criticizing

____ 27. despotism
a. ruling with absolute control
b. removing a stain
c. giving up or surrendering

____ 28. incomparable
a. receiving little pay
b. able to afford
c. without equal

____ 29. apparently
a. easily
b. caring for one's children
c. seemingly

____ 30. fundamental
a. at the base of
b. an enjoyable puzzle
c. interruption of a pattern

____ 31. liberation
a. setting free
b. sharing books
c. drinking too much

____ 32. demolition
a. digging underground
b. destroying or razing
c. lowering in rank

____ 33. improvisational
a. making stronger
b. gaining better eyesight
c. on the spur of the moment

____ 34. contender
a. shopper or customer
b. someone who takes charge
c. competitor

____ 35. redacting
a. bad stage performance
b. loud behavior
c. editing; preparing for publication

____ 36. operationalize
a. to sing in Latin
b. to put into action
c. to perform surgery

____ 37. presentiment
a. giving a gift
b. sensing what is about to happen
c. right now; without delay

____ 38. bravery
a. acting with courage
b. cheering loudly
c. shameful behavior

____ 39. indecision
a. unable to choose
b. inappropriate
c. inaccurate

____ 40. opacity
a. ancient village
b. moving very slowly
c. not letting light through

____ 41. incessant
a. not stopping
b. unscented
c. without warning

____ 42. demotion
a. lowering of rank
b. fluttering
c. without moving

____ 43. indivisible
a. unable to be split
b. barely visible
c. in the future

____ 44. dependable
a. reliable
b. servant
c. unbothered

____ 45. obliterating
a. making smaller
b. wiping out
c. reprimanding

____ 46. addressing
a. putting clothes on
b. speaking or writing to
c. outer ornamental layer

____ 47. coordination
a. shaping raw materials
b. smoothing rough edges
c. harmonious interaction

____ 48. discovery
a. finding something new
b. planetary alignment
c. keeping hidden

____ 49. placidity
a. calmness
b. a fixed location
c. a chemical state

____ 50. defamation
a. making well-known
b. speaking badly of
c. hiding from one's fans

LIST OF REFERENCES

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

Akhtar, N. (2002). Relevance and early word learning. *Journal of Child Language, 29*, 677–686.

Akhtar, N., Dunham, F., & Dunham, P. J. (1989). Directive interactions and early vocabulary development: The role of joint attentional focus. *Journal of Child Language, 18*, 41-49.

Akhtar, N., Jipson, J., & Callanan, M. A. (2001). Learning words through overhearing. *Child Development, 72*, 416–430.

Anderson, R. C., & Freebody, P. (1981). Vocabulary knowledge. In J. T. Guthrie (Ed.), *Reading comprehension and education* (pp. 77–117). Newark, DE: International Reading Association.

Anderson, R. C., Wilson, P. T., & Fielding, L. G. (1988). Growth in reading and how children spend their time outside of school. *Reading Research Quarterly, 23*, 285–303.

Anglin, J. M. (1993). Vocabulary development: A morphological analysis. *Monographs of the Society for Research in Child Development, Serial No. 238*, 58(10).

Arnbak, E., & Elbro, C. (2000). The effects of morphological awareness training on the reading and spelling skills of young dyslexics. Scandinavian Journal of Educational Research, 44, 229–251.

Baldwin, D. A. (1993). Early referential understanding: Infants' ability to recognize referential acts for what they are. *Developmental Psychology, 29*, 832–843.

Baldwin, D. A., & Moses, L. J. (2001). Links between social understanding and early word learning: Challenges to current accounts. Social Development, 10, 309–329.

Bates, E., Marchman, V., Thal, D., Fenson, L., Dale, P., Reznick, J. S., et al. (1994). Developmental and stylistic variation in the composition of early vocabulary. *Journal of Child Language, 21*, 85–123.

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

Beck, I., & McKeown, M. (1990). Conditions of vocabulary acquisition. In R. Barr, M. L. Kamil, P. B. Mosenthal, & P. D. Pearson, (Eds.) *Handbook of Reading Research, Vol. II* (pp. 789–814). New York, NY: Longman.

Becker, W. C. (1977). Teaching reading and language to the disadvantaged--What we have learned from field research. *Harvard Educational Review, 47*, 518–543.

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

Bianchi, S. M., & Robinson, J. (1997). What did you do today? Children's use of time, family composition, and the acquisition of social capital. *Journal of Marriage and the Family, 59*, 332–344.

Bloom, P. (2000). *How children learn the meanings of words*. Cambridge, MA: MIT Press.

Bradley, L. & Bryant, P. E. (1983). Categorizing sounds and learning to read: A causal connection. *Nature, 301*, 419–421.

Brown, J. I., Fishco, V. V., & Hanna, G. S. (1993). *Nelson-Denny Reading Test*. Itasca, IL: Riverside Publishing.

Brown, J. I., Fishco, V. V., & Hanna, G. S. (1993). *Nelson-Denny Reading Test*: *Technical Report Forms G & H.* Itasca, IL: Riverside Publishing.

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

Carlisle, J. J. (1995). Morphological awareness and early reading achievement. In L. B. Feldman (Ed.) *Morphological aspects of language processing* (pp. 189–209). Hillsdale, NJ: Erlbaum.

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., & Nomanbhoy, D. M. (1993). Phonological and morphological awareness in first graders. Applied Psycholinguistics, 14, 177–195.

Carroll, J. B., Davies, P., & Richman, B. (1971). *Word frequency book*. New York: Houghton Mifflin.

Casalis, S., Colé, P., & Sopo, D. (2004). Morphological awareness in developmental dyslexia. *Annals of Dyslexia, 54*, 114–138.

Chall, J. S. (1987). Two vocabularies for reading: Recognition and meaning. In M. G. McKeown & M. E. Curtis (Eds.), *The nature of vocabulary acquisition,* (pp. 7–17). Hillsdale, NJ: Erlbaum.

Chall, J. S., & Jacobs, V. A. (2003). Poor children's fourth-grade slump. *American Educator, 27*, 14–15, 44.

Chung, T. M., & Nation, P. (2003). Technical vocabulary in specialized texts. *Reading in a Foreign Language, 15*, 103–116.

Clark, E. V. (1993). *The Lexicon in Acquisition.* Cambridge: Cambridge University Press.

Clark, E. V. (1995). Language acquisition: The lexicon and syntax. In J. L. Miller and P. D. Eimas (Eds.), *Speech, Language, and Communication*. *Handbook of Perception and Cognition*, (2nd ed.) (pp. 303–337). San Diego: Academic Press.

Corson, D. (1997). The learning and use of academic English words. *Language Learning, 47*, 671–718.

Coxhead, A. (2000). A new Academic Word List. *TESOL Quarterly, 34*, 218–238.

Christian, K., Morrison, F. J., Frazier, J. A., & Massetti, G. (2000). Specificity in the nature and timing of cognitive growth in kindergarten and first grade. *Journal of Cognition and Development, 1*, 429–448.

Cunningham, P. M. (1998). The multisyllabic word dilemma: Helping students build meaning, spell, and read 'big' words. *Reading & Writing Quarterly, 14I,* 189–218.

D'Anna, C. A., Zechmeister, E. B., & Hall, J. W. (1991). Toward a meaningful definition of vocabulary size. *Journal of Reading Behavior, 23*, 109–122.

Dale, E. (1965). Vocabulary measurement: Techniques and major findings. *Elementary English, 42,* 895–901, 948.

Deacon, S. H., Parrila, R., & Kirby, J. R. (2006). Processing of derived forms in high-functioning dyslexics. *Annals of Dyslexia, 56*, 103–128.

Derwing, B. (1976). Morpheme recognition and the learning of rules for derivational morphology. *Canadian Journal of Linguistics, 21*, 38–66.

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

Dolch, E. (1936). How much word knowledge do children bring to grade one? *Elementary English Review, 13*, 177–183.

Donahue, P. L., Finnegan, R. J., Lutkus, A. D, Allen, N. L., & Campbell, J. R. (2001). *The nation's reading report card: Fourth-grade reading 2000.* National Assessment of Educational Progress: Washington, D. C.

Duke, N. K. (2000). 3.6 minutes per day: The scarcity of informational texts in first grade. *Reading Research Quarterly, 35*, 202–224.

Fowler, A. E., & Liberman, I. Y. (1995). The role of phonology and orthography in morphological awareness. In L. B. Feldman (Ed.) *Morphological aspects of language processing* (pp. 157–188). Hillsdale, NJ: Erlbaum.

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

Gaustad, M. G., & Kelly, R. R. (2004). The relationship between reading achievement and morphological word analysis in deaf and hearing students matched for reading level. *Journal of Deaf Studies and Deaf Education, 9*, 269–285.

Gleitman, L. R. (1994). Words, words, words . . . *Philosophical Transactions: Biological Sciences, 346,* 71–77.

Golinkoff, R. M., Shuff-Bailey, M., Olguin, R. (1995). Young children extend novel words at the basic level: Evidence for the principle of categorical scope. *Developmental Psychology, 31*, 494–507.

Goodman, J. C., McDonough, L., Brown, N.B. (1998). The role of semantic context and memory in the acquisition of novel nouns. *Child Development, 69*, 1330–1344.

Goulden, R., Nation, P., & Read, J. (1990). How large can a receptive vocabulary be? *Applied Linguistics, 11*, 341–363.

Hall, D. G., & Graham, S. A.(1999). Lexical form class information guides word-to-object mapping in preschoolers. *Child Development, 70*, 78–91.

Hayes, D. P. (1988). Speaking and writing: Distinct patterns of word choice. *Journal of Memory and Language, 27*, 572–585.

Hayes, D., Wolfer, L. T., & Wolfe, M. F. (1996). Schoolbook simplification and its relation to the decline in SAT-verbal scores. *American Educational Research Journal, 33*, 498–508.

Hirsh-Pasek, K., Golinkoff, R. M., & Hollich, G. (2000). An emergentist coalition model for word learning: Mapping words to objects is a product of the interaction of multiple cues. In R. M. Golinkoff, K. Hirsh-Pasek, L. Bloom, L. B. Smith, A. L. Woodward, N. Akhtar, M. Tomasello, and G. Hollich (Eds.), *Becoming a word learner: A debate on lexical acqusition* (pp. 136–164). Oxford, England: Oxford University Press.

Hoff, E., & Naigles, L. (2002). How children use input to acquire a lexicon. *Child Development, 73*, 418–433.

Hofferth, S. L., & Sandberg, J. F. (2001). How American children spend their time. *Journal of Marriage and Family, 63*, 295–308.

Hurry, J., Nunes, T., Bryant, P., Pretzlik, U., Parker, M., Curno, T.., & Midgley, L. (2005). Transforming research on morphology into teacher practice. *Research Papers in Education, 20*, 187– 206.

Juel, C. (1988). Learning to read and write: A longitudinal study of 54 children from first through fourth grades. *Journal of Educational Psychology, 80,* 437–447.

Katusic, S. K., Colligan, R. C., Barbaresi, W. J., Schaid, D. J. (2001). Incidence of reading disability in a population-based cohort, 1976–1982, Rochester, Minn. *Mayo Clinic Proceedings, 76*, 1081–1092.

Kaye, D. B., Sternberg, R. J., & Fonseca, L. (1987). Verbal comprehension: The lexical decomposition strategy to define unfamiliar words. *Intelligence, 11*, 1–20.

Kelly, R. R., & Gaustad, M. G. (2007). Deaf college students' mathematical skills relative to morphological knowledge, reading level, and language proficiency. *Journal of Deaf Studies and Deaf Education, 12*, 25–37.

Kemp, N. (2006). Children's spelling of base, inflected, and derived words: Links with morphological awareness. *Reading and Writing, 19*, 737–765.

Kidd, E., Lieven, E., & Tomasello, M. (2006). Examining the role of lexical frequency in the acquisition and processing of sentential complements. Cognitive Development, 21, 93–107.

Kuo, L. & Anderson, R. C. (2006). Morphological awareness and learning to read: A cross-language perspective. *Educational Psychologist, 41*, 161–180.

Libben, G., & Jarema, G. (2004). Conceptions and questions concerning morphological processing. *Brain and Language, 90*, 2–8.

Lorge, I., & Chall, J. (1963). Estimating the size of vocabularies of children and adults: An analysis of methodological issues. *The Journal of Experimental Education, 32*, 147–157.

Mahony, D., Singson, M., & Mann, V. (2000). Reading ability and sensitivity to morphological relations. *Reading and Writing: An Interdisciplinary Journal, 12*, 191–218.

Markman, E. M. (1990). Constraints children place on word meanings. *Cognitive Science, 14*, 57–77.

Markson, L., & Bloom, P. (2001). Evidence against a dedicated system for word learning in children. In M. Tomasello and E. Bates (Eds.), *Language development: The essential readings* (pp. 130– 133). Malden, MA: Blackwell.

Marslen-Wilson W., Tyler, L. K., Waksler, R., & Older, L. (1994): Morphology and meaning in the English mental lexicon. *Psychological Review, 101*, 3–33.

Masterson, J., & Hayes, M. (2004). UK data from 197 undergraduates for the Nelson-Denny Reading Test. *Journal of Research in Reading, 27*, 30–35.

Maylath, B. (1997) Why do they get it when I say 'gingivitis' but not when I say 'gum swelling'? *New Directions for Teaching and Learning, 70*, 29–37.

McKinnon, R., Allen, M., & Osterhout, L. (2003). Morphological decomposition involving non-productive morphemes: ERP evidence. *Cognitive Neuroscience and Neuropsychology, 14,* 883–886.

McBride-Chang, C., Wagner, R. K., Muse, A., Chow, B. W.-Y., & Shu, H. (2005). The role of morphological awareness in children's vocabulary acquisition in English. *Applied Psycholinguistics, 26*, 415–435.

Merriam-Webster (2006-2007). New words. Retrieved on February 1, 2007, from Merriam-Webster Online from http://www.m-w.com/info/new_words.htm

Miller, G. M., & Wakefield, P. C. (1993). On Anglin's analysis of vocabulary growth analysis. *Monographs of the Society for Research in Child Development, Serial No. 238*, 58, 167–175.

Moats, L. C., & Smith, C. (1992). Derivational morphology: Why it should be included in language assessment and instruction. *Language, Speech, and Hearing Services in Schools, 23,* 312–319.

Moore, C., Angelopoulos, M., & Bennett, P. (1999). Word learning in the context of referential and salience cues. *Developmental Psychology, 35*, 60–68.

Nagy, W. E., & Anderson, R. C. (1984). How many words are there in printed school English? *Reading Research Quarterly, 19*, 304–330.

Nagy, W., Anderson, R. C., Schommer, M., Scott, J. A., & Stallman, A. C. (1989). Morphological families in the internal lexicon. *Reading Research Quarterly, 26*, 262–282.

Nagy, W. E., & Anderson, R. C. (1995). Metalinguistic awareness and literacy acquisition in different languages. Technical Report No. 618, Center for the Study of Reading, University of Illinois at Urbana-Champaign.

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

Nagy, W., Berninger, V., Abbott, R., Vaughan, K., & Vermeulen, K. (2003). Relationship of morphology and other language skills to literacy skills in at-risk second-grade readers and at-risk fourth-grade writers. *Journal of Educational Psychology, 95, 7*30–742.

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

Nagy, W. E., & Scott, J. A. (2000). Vocabulary processes. In M. L. Kamil, P. B. Mosenthal, P. D. Pearson, & R. Barr (Eds.), *Handbook of Reading Research, Volume III* (pp. 269 –284). Mahwah, NJ: Erlbaum.

Nation, I. S. P. (2001). *Learning vocabulary in another language.* Cambridge: Cambridge University Press.

Nelson, K. (1988). Constraints on word learning. *Cognitive Development, 3*, 221–246.

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

Nunes, T., Bryant, P., & Bindman, M. (2006). The effects of learning to spell on children's awareness of morphology. *Reading and Writing, 19*, 767–787.

Olguin, R. & Tomasello, M. (1993). Twenty-five-month-old children do not have a grammatical category of verb. *Cognitive Development, 8*, 245–272.

Ouellette, G. P. (2006). What's meaning got to do with it? The role of vocabulary in word reading and reading comprehension. *Journal of Educational Psychology, 98,* 544–566.

Pinker, S. (1994). *The Language Instinct*. New York: Harper Collins.

Samuelson, L. K., & Smith, L. B. (1998). Memory and attention make smart word learning: An alternative account of Akhtar, Carpenter and Tomasello. *Child Development, 69*, 94–104.

Savage, R., Blair, R., & Rvachew, S. (2006). Rimes are not necessarily favored by prereaders: Evidence from meta- and epilinguistic phonological tasks. Journal of *Experimental Child Psychology, 94*, 183–205.

Shaywitz, S. E., & Shaywitz, B. A. (2005). Dyslexia (Specific reading disability). *Biological Psychiatry, 57*, 1301–1309.

Shibles, B. H. (1959). How many words does a first grade child know? *Elementary English, 36*, 41–47.

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, L. B. (1999). Children's noun learning: How general learning processes make specialized learning mechanisms. In B. MacWhinney (Ed.), *The emergence of language*, (pp. 277–303). Mahwah, NJ: Erlbaum.

Stanovich, K. E. (1986). "Matthew effects" in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly, 4*, 360–407.

Tomasello, M. (2001). The item-based nature of children's early syntactic development. In M. Tomasello & E. Bates (Eds.) *Language development: The essential readings* (pp. 169–186). Malden, MA: Blackwell.

Tomasello, M. (1995). Joint attention as social cognition. In C. Moore & P. J. Dunham (Eds.), *Joint attention: Its origins and role in development*, (p.103–130). Hillsdale, NJ: Erlbaum.

Tomasello, M., & Barton, M. (1994). Learning words in nonostensive contexts. *Developmental Psychology, 30*, 639–650.

Tomasello, M., & Farrar, M. J. (1986). Joint attention and early language. *Child Development, 57*, 1454–1463.

Topping, K. J., & Paul, T. D. (1999). Computer-assisted assessment of practice at reading: A large scale survey using Accelerated Reader data. *Reading & Writing Quarterly, 15*, 213–231.

Tyler, A., & Nagy, W. (1989). The acquisition of English derivational morphology. *Journal of Memory and Language, 28*, 649–667.

Verhoeven, L., & Carlisle, J. F. (2006). Introduction to the special issue: Morphology in word identification and word spelling. *Reading and Writing, 19*, 643–650.

Wagner, K. R. (1985). How much do children say in a day? *Journal of Child Language, 12*, 475–487.

Wang, M., Cheng, C., & Chen, S.-W. (2006). Contribution of morphological awareness to Chinese-English biliteracy acquisition. *Journal of Educational Psychology, 98*, 542–553.

White, T., Power, M., & White, S. (1989). Morphological analysis: Implications for teaching and understanding vocabulary growth. *Reading Research Quarterly, 24*, 283–304.

Windsor, J., & Hwang, M. (1999). Derivational suffix productivity for students with and without language-learning disabilities. *Journal of Speech, Language, and Hearing Research, 42*, 220–230.

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

BIOGRAPHICAL SKETCH

Lisa Kay Maag was born in Pensacola, Florida, and she grew up in the Washington, D. C. area and in Southern California. Her original career goal was to be a botanist, and she earned a Bachelor of Science degree in biology, and later, a Master of Business Administration degree. She worked mainly in small business management, but also spent a few years as a high school science teacher. Her father had earned a Ph.D. in psychology at the University of Florida, and she initially had no intention of studying psychology, but eventually she returned to Florida and decided to pursue her interest in language development and its relation to cognitive skills. This led to graduate school at the University of Florida, and (after an interruption of several years), to earning a Ph.D. in developmental psychology. She is a faculty member of the University of Phoenix, where she teaches psychology and related courses. She plans to continue her research in the development of morphological awareness and vocabulary and to continue to collect a wide variety of flowering plants.