WORD LEARNING BY ADULTS WITH LEARNING DISABILITY: EFFECT OF GRAMMATICAL CLASS.

by

Megha Bahl

A Dissertation Submitted to the Faculty of the

DEPARTMENT OF SPEECH, LANGUAGE AND HEARING SCIENCES

In Partial Fulfillment of the Requirements
For the Degree of

DOCTOR OF PHILOSOPHY

In the Graduate College

THE UNIVERSITY OF ARIZONA

2009

THE UNIVERSITY OF ARIZONA
GRADUATE COLLEGE

As members of the Dissertation Committee, we certify that we have read the dissertation prepared by Megha Bahl
entitled "Word learning by adults with learning disability: Effect of grammatical class"
and recommend that it be accepted as fulfilling the dissertation requirement for the Degree of Doctor of Philosophy

____ Date: 12/11/2009
Elena Plante

____ Date: 12/11/2009
Mary Alt

____ Date: 12/11/2009
Gayle DeDe

Final approval and acceptance of this dissertation is contingent upon the candidate's submission of the final copies of the dissertation to the Graduate College.

I hereby certify that I have read this dissertation prepared under my direction and recommend that it be accepted as fulfilling the dissertation requirement.

____ Date: 12/11/2009
Dissertation Director: Elena Plante

STATEMENT BY AUTHOR

This dissertation has been submitted in partial fulfillment of requirements for an advanced degree at the University of Arizona and is deposited in the University Library to be made available to borrowers under rules of the Library.

Brief quotations from this dissertation are allowable without special permission, provided that accurate acknowledgment of source is made. Requests for permission for extended quotation from or reproduction of this manuscript in whole or in part may be granted by the head of the major department or the Dean of the Graduate College when in his or her judgment the proposed use of the material is in the interests of scholarship. In all other instances, however, permission must be obtained from the author.

SIGNED: Megha Bahl

ACKNOWLEDGMENTS

I am grateful to my advisor, Dr. Elena Plante, for her guidance and encouragement throughout my five-year doctoral study at the University of Arizona. I have learned an enormous amount working in the Plante Lab under her direction. I am thankful for her trust in me and the opportunities she gave me to grow not just as a researcher but also as a person. I am also thankful to my committee members Dr. Mary Alt, Dr. Gayl;e DeDe, and my minor committee member Dr. LouAnn Gerken, for their guidance and encouragement. I also thank other SLHS faculty members for their support during my studies.

I want to thank my close friends in the US and in India for their emotional support and the fun times that kept me going. My father has been a great inspiration and I have always tried to live up to his philosophy of simple living and high thinking. I owe a big part of my success to him. My mother has been my best friend and a great guide throughout my life. I am thankful to my parents and my parents-in-law for their faith in me. Most of all, I am very grateful for the constant support, understanding, patience, and love of my husband, Siddharth. He has always showed me the light at the end of the tunnel. Without Siddharth, this would not have been possible. Thank you.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

ABSTRACT

A novel word learning paradigm in a reading context was employed to investigate the ability of adults with and without learning disability to learn new words. The participants were required to read a short English story. The story was based on an Indian folk tale to eliminate any confounding effect of familiarity with content. Two nouns and two verbs from the story were replaced by novel words. The story was read in three sections. The target non-words occurred once in the first section, allowing for fast mapping of the words. The non-words occurred three times each in the second and the third sections of the story allowing for additional slow mapping. After reading each section, participants were tested for different aspects of lexical acquisition such as production of words, comprehension of the content, and grammatical knowledge associated with the non-word. This allowed for an examination of the growth in learning with increased exposure to the words in context. Results indicated that the normal language group performed significantly better than the learning disability group. Moreover, nouns were more easily learned than verbs. The overall performance of both groups improved with each section read, suggesting that more experience with the word assisted learning of novel forms.

CHAPTER 1: INTRODUCTION

The word-learning process

Lexical acquisition is one of the most vital and challenging tasks in language learning. It begins with a simple association of the phonetic form of the word with the corresponding object or action in the environment. This process is commonly referred to as fast mapping or incidental learning and involves an incomplete representation of the word (Carey & Bartlett, 1978). This initial association grows stronger and more robust with extended and multiple exposures, a process known as slow mapping (Carey, 1978).

The seemingly automatic and effortless process of lexical acquisition is inherently complex for two reasons. First, learners have the difficult task of choosing the correct referents for words out of an infinite set of possibilities. Quine (1960) named this challenge as the induction problem. For instance, on hearing the word 'dog' in a sentence like this: 'Look! That is a dog', while the adult points to a black dog, the child can attach the word 'dog' to the dog, but he can also attach it to a particular feature of the entity (e.g. black color or its tail). In other situations, when adults do not necessarily point to an object, the child can link the word with things in the environment surrounding the entity. Thus, in any given situation, upon hearing a novel word, the task of choosing the correct referent and making the correct inference is of great importance and difficulty.

Secondly, in addition to successfully choosing the correct referent out of the myriad of potential referents, novel word learning involves integration of multiple components of language such as phonology, morphology, syntax, semantics, and pragmatics. For example, sensitivity to phonological elements is necessary to parse a continuous speech stream into meaningful units. Once these units are recognized, morpho-syntactic cues help the learner group words into different grammatical categories. Semantic and conceptual knowledge attached to the referent of the word is also a vital aspect of lexical acquisition involving encoding features of the referent unique to it. Finally, attention to pragmatic cues (e.g., joint attention) assists learners in linking words to appropriate referents. Each of these components thus, lends itself uniquely to a complete understanding of any given lexical item.

Despite these challenges, infants not only successfully accomplish this task; they do it at a fast rate, adding approximately eight to ten new words per day to their receptive vocabularies (Beck & McKeown, 1991; Nagy & Herman, 1987), and a total of roughly 60,000 words by 15 years of age (Aitchison, 1994; Bloom, 2000). A critical question that arises, then, is how children accomplish this monumental task so efficiently. Three main approaches to the problem have been proposed: Association theory, Constraint theory and Pragmatic theory.

Associative learning for words posits that children acquire words by one to one association of the phonetic form and the object established by co-occurrence. The words refer to objects in the immediate environment and learners do not require any *a priori* knowledge of language systems. Language learning within this theoretical framework does not rely on any abstract concepts and is easy to understand, however, it fails, in its traditional form, to explain the ability of children to generalize linguistic as well as non-linguistic information to concepts beyond the observable phenomenon.

The word-object pairings proposed within the associative learning framework is rather simplistic and has been criticized on grounds of insufficiency to explain the induction problem (Markman, 1991). It has been suggested that learning based solely on modeling every word-object pair does not explain the generalizations and the pattern of learning shown by young learners. Alternatively, many researchers have seen a solution to the induction problem in constraints on word learning (Carey, 1978; Golinkoff, Mervis, & Hirsh-Pasek, 1994; Imai, Gentner, & Uchida, 1994; Landau, Smith, & Jones, 1988; Markman, 1989, 1992; Markman & Hutchinson, 1984; Merriman & Bowman, 1989). Biases that a learner has towards choosing one referent over another for a given word (Hatano & Inagaki, 2000) are believed to exclude many candidates as possible referents to a novel word thereby limiting the hypothesis space available for the learner to choose from. Moreover, the biases are spread over several domains such as perceptual, semantic, syntactic and pragmatic (Brown, 1957; Carey, 1978; Clark, 1987; Clark, 1993;

Fisher, Hall, Rakowitz, & Gleitman, 1994; Gleitman, 1990; Golinkoff et. al., 1994; Imai et. al., 1994; Landau, 1994; Landau et. al., 1988; Markman, 1989, 1990, 1994; Merriman & Bowman, 1989; Mervis & Bertrand, 1994; Soja, Carey, & Spelke, 1991; Waxman & Kosowski, 1990; Waxman & Markow, 1995).

Markman and colleagues proposed that children are born with a word learning constraint, namely, "*Mutual Exclusivity*" (Markman, 1989; Markman & Watchel, 1988; Merriman & Bowman, 1989). They found that when 3-4 year old children were presented with a familiar and an unfamiliar object and introduced to a novel label, they attached the label to the unfamiliar object. They suggested that children are predisposed with a bias towards attaching an unfamiliar name only to an object they do not have a label for. Additionally, they avoid naming an object with a label that has already been assigned to another object. Children's tendency to attach a novel name to a novel object has been explained by other principles as well. Clark (1983, 1987) proposed the *Principle of Contrast*, positing that a contrast in the phonetic form will have contrasting referents thus avoiding synonyms for a referent. In other words, children expect that the referents to two words with different phonetic form will have distinguishable features. Mervis et. al. (1994) contributed another possible explanation for this tendency, not in terms of rejecting a familiar object as a referent (Mutual exclusivity), but in terms of a natural preference of novelty to novelty mapping (Novel name nameless category (N3C) principle). A pragmatic account of this novel to novel mapping has also been investigated. Diesendruck and Markson (2001) proposed that children are able to detect subtle cues in adults' usage of words. According to this principle, children choose a novel referent for a novel word in the presence of objects familiar to them and to the adults by assuming that the adult will use the known familiar label if he intends to talk about the familiar object.

Another constraint known as the "*Taxonomic Assumption*" was proposed within the nativist theory of lexical acquisition (Markman & Hutchinson, 1984; Waxman & Kosowski, 1990). This constraint addresses a bias towards extending a label to include objects that are taxonomically related. Findings of Markman and Hutchinson (1984) show that when children were shown two objects that were taxonomically related (cat and dog) and another object that was thematically related to one of the objects (bone), they grouped the two taxonomically related objects. When 'dax' was used to label a dog during familiarization, they generalized the label 'dax' to the similar object in the same basic category (cat). Moreover, when infants were asked to find X (a novel label), they attached the new label to the bone.

Yet another constraint is popularly known as the "*Whole Object*" constraint (Markman, 1989; Mervis, 1987). According to this, children attach novel words to whole objects rather than to a part of the object. This is linked to the example illustrated above and seems to explain why children attach the word 'dog' to the dog and not a constituent part of the dog. Much discussion in the field has targeted the conflicting nature of the *Whole Object* and *Mutual Exclusivity* constraint. Investigators argue that when a part name of a familiar object is taught to a child (for example, 'tail'), according to the *Mutual Exclusivity* constraint he is expected to look for a referent other than the familiar object, which may guide him to the correct referent. However, according to the *Whole Object* constrain, the child should immediately associate the label with the object (dog). Some have explored the possibility of a priority of one constraint over another in case where these two principles collide (Mervis, 1987; Mervis, Golinkoff & Bertrand, 1994; Waxman & Hatch, 1992; Waxman & Senghas, 1992) whereas others have provided a pragmatic insight to how infants learn part names despite the *Whole Object* constraint (Saylor, Sabbagh & Baldwin, 2001). Saylor et al. (2001) showed that when adults attempt to teach part names to children, the adults almost always juxtapose it with the whole object label prior to introducing the part label. This juxtaposition, according to this principle, is the driving force behind children's tendency to seek a referent other than the whole object. Saylor et al. (2001) familiarized children with an object (a picture of a butterfly) and subsequently tested them on a task where they were asked a question about '*thorax*' (a novel word associated with a salient part of the butterfly) in two conditions. In the first condition, children were simply asked to show 'thorax' and in the other they were told 'See this *butterfly*? What color is the *thorax*?" In the second condition, children pointed to a salient part of the picture significantly more often than the children in the first condition.

Despite the fact that these constraints and biases seem to provide a reasonable solution to the induction problem, the origin of these biases has been a matter of debate. Whereas one set of investigators believe that children are predisposed to biases that place a constraint on possible meanings for a novel word (e.g. Golinkoff et.al, 1994; Markman, 1989, 1991, 1994), others suggest that the constraints are induced and developed by learning experience supported by the non-verbal cognitive abilities such as attention to similarity in physical properties of objects (Jones & Smith, 1993; Landau et. al., 1988; Smith, Jones & Landau, 1996).

Landau et al. underscore the importance of associative learning and cognitive systems supporting the mechanism to find repetitive patterns in the input in early word learning. For example, Landau and colleagues have argued in favor of a bias in the perceptual and conceptual domain showing that children encode the shape of objects when learning their names and consider it as the best indicator of the syntactic category. (Imai et al., 1994; Jones, Smith & Landau, 1991; Jones & Smith 1993; Landau et al. 1988; Smith, 1999). They showed that 2-3 year old children generalize a novel word to include objects that have the same shape. Researchers have argued against either the existence of shape bias (Cimpian & Markman, 2005) or the emergence of shape bias as a result of experience (Booth, Waxman & Huang, 2005). However, Smith and Samuelson (2006) have demonstrated that a shape bias exists and indeed serves as an attentional learning mechanism that helps children extend word references to include the objects of the same shape. A supporting factor to this account is that the shape bias is present in slightly older children and is not present from birth. Other investigations have also lent support to the notion of learned nature of constraints. Imai and colleagues demonstrated that Japanese 2-year-olds learn novel names for familiar objects by relying on the *acquired* conceptual and perceptual knowledge, such as shape and material, thus, overriding the mutual exclusivity assumption (Haryu & Imai, 2002; Imai, 1999).

This group of researchers suggests that pre-existing biases, if any, are readily ignored in the presence of the information present in the surroundings (Bloom, 2000; Cimpian & Markman, 2005; Gelman & Coley, 1991; Gelman & Diesendruck, 1999; Golinkoff, Hirsh-Pasek, Bloom, Smith, Woodward, Akhtar, Tomasello & Hollich, 2000; Hirsh-Pasek, Golinkoff & Hollich, 2000; Hollich, Hirsh- Pasek, Golinkoff, Brand, Brown, Chung, Hennon & Rocroi, 2000; Markman, Wasow & Hansen, 2003; Samuelson, 2002; Tomasello & Akhtar, 2003). This information is available in the form of gestural cues and socio-pragmatic cues or in the phonological, perceptual/semantic or syntactic cues. Human beings analyze the distributional properties and frequency of occurrence of these cues in the input to form generalizations about word-object associations. Thus, there is a great deal of reliance on the input, as well as the human non-verbal cognitive ability to use it, within this learning paradigm. The computation of statistical co-occurrence has been shown to occur at all levels of linguistic processing: phonological, semantic, morpho-syntactic and pragmatic.

Phonological effects: Prosodic cues, Phonotactic cues and Speaker variability

There is a significant amount of research showing that phonology is deeply involved at the very outset of the lexical acquisition process (Christophe, Dupoux, Bertoncini, & Mehler, 1994; Christophe, Mehler, & Sebastián-Gallés, 2001; Curtin, Mintz, and Christiansen, 2005; Cutler, 1994; Friederici & Wessels, 1993; Gerken, 2004; Johnson and Jusczyk, 2001; Jusczyk, Luce, & Charles-Luce, 1994; Kemler-Nelson, Hirsh-Pasek, Jusczyk, & Cassidy, 1989; Saffran, Newport & Aslin, 1996; Thiessen and Saffran, 2003; Zamuner, Gerken & Hammond, 2004). Infants' sensitivity to the phonological characteristics of speech begins to develop even before they are born. These characteristics include prosodic and phonological information encoded in the language as well as the acoustic signal of the voice of the speaker (DeCasper & Fifer, 1980; DeCasper, Lecanuet, Busnel, Deferre & Maugeais, 1994; DeCasper & Spence, 1986; Moon, Cooper, & Fifer, 1993; Nazzi, Jusczyk, & Johnson, 2000; Soderstrom, Seidl, Kemler Nelson, & Jusczyk, 2003).

Prosodic cues.

Prosodic cues are both available and used early in human development (Beach, 1991; Christophe, Gout, Peperkamp & Morgan, 2003; Mandel, Jusczyk, & Kemler Nelson, 1994; Price, Ostendorf, Shattuck-Hufnagel, & Fong, 1991). Gerken (2004) showed that infants as young as 9 months old learn complex rules of stress implicitly and generalize these rules in the context of an artificial language (Gerken, 2004). Moreover, several investigations show that prosodic cues help in various language processing tasks such as speech segmentation and syntactic disambiguation, which form the first steps in lexical acquisition task (Gerken, Jusczyk, & Mandel, 1994; Jusczyk, Houston, & Newsome, 1999; Jusczyk & Kemler Nelson, 1996; Kemler Nelson et al., 1989). Prosodic cues also assist in processing language at a lexical level. Jusczyk, Cutler and Redantz (1993) presented 9-month-old English-speaking infants with 2 types of words from a novel language, one with a typical strong weak and another with an atypical weak strong lexical stress pattern. The infants were able to discriminate between the two types solely on the basis of prosodic cues.

Phonotactic cues

In addition to the prosodic properties of language, phonological information also helps children perform linguistic functions, including extracting lexical items from fluent speech (Mattys & Jusczyk, 2001; Mattys, Jusczyk, Luce, & Morgan, 1999). Saffran, Newport and Aslin (1996) demonstrated that children are capable of using probability of phoneme co-occurrence at word boundaries to extract tri-syllabic words from a fluent speech stream. Several other investigations have likewise demonstrated the importance of sound sequences in word learning (Christophe, Mehler, & Sebastián-Gallés, 2001; Christophe et. al., 1994; Curtin et. al.,2005; Cutler, 1994; Johnson and Jusczyk, 2001; Jusczyk, Friederici, Wessels, Svenkerud & Jusczyk, 1993; Kemler-Nelson et.al., 1989; Saffran, Newport, Aslin, Tunick, & Barrueco, 1997; Storkel, 2003). For example, American and Dutch 9-month-olds can discriminate English from Dutch words based on differences in the sound sequences that are legal versus illegal in the two languages (Jusczyk et al., 1993). The effect of phonotactic probability on the production of novel words has also been documented in adults (Vitevitch & Luce, 1999; 2002).

The preference of a frequently occurring sound sequence over an infrequently occurring one when both are permissible in the infants' native language shows that this ability is not just due to infants' understanding of the legality of their native language phonotactics but due to the preference for a particular phonological sequence over others (Jusczyk, et. al., 1994). In similar experiments, Storkel and colleagues found that 10- to 11-month-old infants as well as 3- to 5-year-old children looked significantly longer when they heard words with higher within word phonotactic frequency (Storkel, 2003; Storkel & Rogers, 2000). These results suggest that infants at a very young age are highly sensitive to the statistical frequency with which sound sequences co-occur and thus have a capability to analyze the phonological information stored in the utterances.

Speaker variability

Human beings are highly sensitive to very fine differences in the linguistic and non linguistic aspects of speech input. Besides prosody and phonotactics, another aspect of phonology that infants successfully exploit to their advantage is acoustic variability across speakers (Jusczyk, Pisoni, and Mullennix, 1992; Richtsmeier, Gerken, Goffman & Hogan, 2009). This ability of the infants to encode the speaker's voice was investigated by Jusczyk and colleagues in a number of experiments. For example, Jusczyk, Pisoni, and Mullennix (1992) employed the high amplitude sucking (HAS) procedure to show that 2-month-olds prefer a consonant–vowel–consonant (C–V–C) syllable (e.g., bug) produced by multiple talkers over a single talker when there is delay between habituation and dishabituation phases. They concluded on the basis of these findings that talker information is considered by infants as young as 2 month old when encoding speech sounds in long-term memory.

Converging phonological cues

As discussed above, human beings constantly attend to the distributional properties of the speech input and take advantage of the various cues present in the input to learn novel lexical forms. Some researchers have proposed that these cues taken together provide learners a strong base to arrive at the correct generalizations about word boundaries that assist them in finding novel words and using them grammatically in sentences (Christiansen, Allen, & Seidenberg, 1998; Johnson & Jusczyk, 2001). At every stage of the process of lexical acquisition, including extracting words by speech segmentation, assigning them a syntactic class, and finally understanding their concepts, individuals appear to analyze the distributional patterns of the input.

There is also evidence that, in cases where multiple cues collide, one cue may take precedence over another. Nine month old participants in Mattys et al. (1999) showed that both prosodic and phonotactic cues are at play during lexical acquisition, even though the extent of their contributions differs at various developmental stages and in different contexts. In their investigation, they performed a series of experiment using 2 syllable CVC.CVC words with variable stress pattern and variable degree of phonotactic frequency (frequency of C.C in CV<u>C.C</u>VC). Frequency of C.C was either high *in between* English words or *within* English words. The findings suggested that if the words had a typical lexical stress (strong-weak), words with high phonotactic frequency of C.C within the word were preferred over those that had high phonotactic frequency between words; if the words had a weak strong stress pattern (atypical of lexical stress in English) opposite pattern of performance was observed and CVC.CVC were perceived as 2 words of 1 syllables each. These observations indicate that when both cues are present, these cues converge to indicate word boundaries. In a subsequent experiment, participants heard words where these two cues collided. Participants were presented with 2 kinds of words: CVC.CVC words with *typical* lexical stress but high *between* word C.C frequency; CVC.CVC words with *atypical* lexical stress but high *within* word C.C frequency. Participants relied on prosodic cues and ignored the phonotactic cues in this context and selected syllables with typical stress pattern more often as words even though the phonotactic frequency of C.C in the word favored a between word division of syllables.

***Morpho-syntactic cues*:** Inflectional regularity, Positional cues

It is well known that children acquire and produce the morphological components of their native language early in their development (Brown, 1973). It is not surprising that their sensitivity towards these elements is activated much before they begin to produce them. Once the words are segmented from the speech stream and recognized as individual units, morpho-syntactic cues assist children in categorizing and classifying the words into various grammatical classes. For example, the past tense marker '–ed' in 'talked' and 'walked' assists children in grouping the two words in one category (verbs). Gerken, Wilson and Lewis (2005) highlighted the importance of morpho-syntactic structure in the word learning process. In their study, learners computed the distribution of two morpho-phonological markers to arrive at correct generalizations regarding the syntactic categories of novel words. In their study, infants as young as 1.5 year old were able to discriminate grammatical from the ungrammatical on the basis of double marking for gender in Russian words. These inflectional cues also contribute to comprehension of novel words. Bedore and Leonard (2000) showed that 37-41 month old children's comprehension was influenced by inflectional variation of the words. Children who were tested on words with the same morphological endings as the familiarization words performed significantly better than those with inconsistent endings. Moreover, positional cues serve as an additional tool for enhanced learning of novel words. For example, an article such as 'a' or 'the' preceded by a noun makes the noun category more salient for learners (Hall, Waxman, & Hurwitz, 1993; Mintz & Gleitman, 2002; Taylor & Gelman, 1988). A considerable amount of research has shown that the various forms of morphological and syntactic information inherent in utterances provide useful data concerning the grammatical class, tense, and plurality. Thus, learners rely greatly on the regularity of morpho-syntactic information in the process of word learning to categorize them in correct syntactic category (Cartwright & Brent, 1997; Gleitman, 1990; Maratsos & Chalkley, 1980; Mintz, Newport, & Bever, 2002; Redington, Chater, & Finch, 1998; Wilson, Gerken, and Nicol, 2000).

Semantic effects

Many researchers propose that word naming is not equal to learning a word. Some studies, however, suggest that naming is influenced greatly by the extent of the conceptual knowledge encoded (Alt, Plante, & Creusere, 2004; Alt & Plante, 2006; McGregor, Friedman, Reilly & Newman, 2002). McGregor, Friedman, Reilly and Newman (2002) showed that naming is positively and strongly correlated to the amount of semantic features coded by five year old participants. In their experiment, participants were asked to name 20 line drawings followed by drawing and definition task and the results suggested that the two abilities were correlated. Moreover, Landau, Smith and Jones (1988) showed that both infants and adult participants, who were shown familiar objects with novel labels attached to them, generalized the names to novel objects that preserved the shape of familiar objects (Shape bias). These findings show that in learning labels, children encode semantic features attached to the objects. When a child first encounters a word, he maps the word to an initial incomplete concept (fast mapping) and adds meaning to it in subsequent exposure in multiple contexts.

The role of semantics in novel word learning is supported by research investigations comparing response latencies in naming words. The studies compare the performance of participants in learning words that are semantically similar and dissimilar to the exposure words (Levelt, Roelofs, & Meyer, 1999; Viglioccoa, Vinson, Damian, & Levelt, 2002). Results consistently show that semantically dissimilar items are easier to learn than semantically similar items. It is believed that in learning a word in the context of other semantically related words causes 'interference' due to activation of multiple items. These findings support the involvement of conceptual knowledge in encoding and decoding a novel lexical item.

Pragmatic effects

Apart from cues present in the language itself, there are other cues offered by the speaker and the context that assist learners in novel lexical acquisition. In support of the pragmatic view, Akhtar, Carpenter and Tomasello (1996) examined the mutual exclusivity constraint and proposed that instead of Mutual Exclusivity children may be using pragmatic tools to link a novel label to a novel object such as novelty of the object to the speaker. In their experiment, two experimenters and the child played with a set of toys together without any labeling. This was followed by the departure of the first experimenter from the room for a brief duration, while the child continued to play with the toys. A new toy was introduced by the second experimenter while the first experimenter was away. On returning, the first experimenter used a novel label without pointing to or looking at the target object. The results showed that children associated the novel label with the object that was novel to the speaker suggesting that children are sensitive to adults' intentions.

Baldwin and colleagues, as well others in the field, have suggested that language users provide many important socio-pragmatic cues which enable novel word learners to choose the correct referents from the environment (Baldwin, 1993; Baldwin, Markman, Bill, Desjardins, Irwin & Tidball, 1996; Brooks & Meltzoff, 2005; Butterworth & Jarett, 1991; Tomasello & Akhtar, 1995). Joint attention is one such cue that has been shown to enhance learning of novel labels (Baldwin, 1991; Baldwin et. al., 1996; Tomasello & Farrar, 1986; Woodward, Markman, & Fitzsimmons, 1994). Baldwin et al. (1996) presented 18-20 months old participants with novel toys with half the participants in the in-view experimenter condition (child and experimenter jointly attended to the object with no explicit cues) and half the participants in out of the view experimenter condition (participant played alone with the object). They observed that the comprehension of object names was better in the in-view experimenter condition (Baldwin et. al., 1996). The *whole-part* juxtaposition mentioned previously is another cue that can be considered from a pragmatic perspective. Saylor and colleagues (2002) found that word learning in three to four year old children was greatly enhanced when adults mentioned the whole object name before introducing a novel part term (See this cup! This is the rim) (Saylor, Sabbagh & Baldwin, 2002). These findings indicate that there are multiple cues present to help the child acquire new lexical items. These cues likely work together to make the word learning task possible. Different cues are, however, available and used at different points in the development.

Although the information necessary for word learning is present in various linguistic domains, the ability to process it is not domain specific. A general purpose cognitive mechanism has been hypothesized that enables children to recognize patterns in the environmental language and capitalize on these regularities to support word learning (Saffran, 2002; Saffran, Johnson, Aslin & Newport, 1999). Proposals concerning the statistical learning in children and adults favor the domain general side of a long standing debate in the literature concerning with the domain specificity of these abilities and cues. Some believe that word learning, and other linguistic tasks, are accomplished by language - specific mechanisms. Others have shown that the non-verbal abilities that support word learning are the same as those that support other non linguistic functions as well. The proponents of statistical learning approach emphasize that the non-verbal cognitive capacities employed in the analysis of word learning and other linguistic data are not dedicated to language learning alone.

A critical piece of evidence of domain general account is provided by Saffran and colleagues who showed that children employed statistical cues not only to linguistic stimuli but also to non-linguistic stimuli. In a series of experiments, participants were presented with non-words and different sounds with specific distributional properties. Participants generalized these characteristics in both kinds of stimuli and showed successful learning in an implicit learning task. It should be noted that the learning did not extend to visual stimuli; nevertheless, the findings provide evidence against a linguistic specific learning mechanism (Saffran, 2002; Saffran, Johnson, Aslin &

Newport, 1999). Further evidence comes from analyzing the word learning abilities of language impaired individuals and tracing the root deficit which might be simply surfacing as a problem in one or more domain of language.

Grammatical class effects

Another area where a domain general account is shown to best explain the learning mechanisms is learning words from different grammatical class. Children at a very young age are sensitive to the categorical differences of words (Valian, 1991). Many studies have shown that words from one grammatical class are easier to learn than the other. These differences have been found in adjectives versus nouns in observational studies looking at the early vocabulary of children (Dromi, 1987, Gentner, 1978; Maldonado, Thal, Marchman, Bates & Gutierrez-Clellen, 1993; Nelson, 1973; Sandhofer & Smith, 2007) and in experimental studies looking at word learning ability using artificial language (Au & Markman, 1987; Carey, 1978; Smith, Jones & Landau, 1996; Taylor & Gelman, 1988). Moreover, the literature is replete with findings on noun and verb learning differences (Alt, Plante & Creusere, 2004; Gentner, 1982; Gentner & Boroditsky, 2001; Waxman & Lidz, 2006; Woodward & Markman, 1998). Differential performance on noun and verb learning in children has predominantly indicated the greater ease of learning nouns over verbs. Children learn a greater proportion of nouns than verbs even when the input provided to them is balanced across the two categories of words (Imai, Haryu & Okada, 2005; Leonard, Schwartz, Morris & Chapman, 1981; Merriman, Marazita & Jarvis, 1993). Many attempts to explain the noun advantage have been made in different domains of language. A common finding from these investigations is that nouns are "less complex" and therefore easier to learn and this finding supports the domain general processing deficit theory. However, whether it is the semantic complexity or morpho-syntactic complexity that contributes to the differences in the two types of words is an ongoing debate.

Morphological and syntactic cues assist language learners in categorizing words and identifying their grammatical classes and any impairment in these areas can lead to poor interpretation and assignment of lexical items to their corresponding referent. There is substantial evidence in the literature that children and adults employ morphosyntactic information in novel word learning. Verbs have more variation in morphosyntactic information ('ed', 'ing' and irregular verbs) than nouns ('s') which may lead to a difficulty in learning verbs relative to nouns. Research in the area has shown that individuals tend to show difficulty in learning verbs if morpho-syntactic information is inconsistent ('slipping' vs. 'slipped') in the training phase relative to the familiarization phase (Bedore & Leonard, 2000). Additional support for the argument comes from the investigations in language impaired population. Children with SLI have difficulty in processing verb morphology which makes this class of words difficult for them to learn

(Leonard et al., 1992; Rice et al., 1994; Rice & Wexler, 1996). Leonard and colleagues demonstrated that children with specific language impairment, who are known to have difficulty with processing grammatical morphemes, performed worse than typically developing peers in learning verbs especially when the morphological form was inconsistent during the experiment and the testing phase (Leonard et al., 1992).

One of the main arguments underlying the linguistic basis of noun advantage is that the complex linguistic information required to learn verbs is not yet accessible by early word learners (Gillette, Gleitman, Gleitman & Lederer, 1999). However, studies of older typically developing children and adults also indicate that novel nouns are more readily learned than novel verbs (Spenney & Haynes, 1989). However, older children and adults have fully acquired morphological forms. Therefore, the morphological complexity of verbs should no longer be challenging at these ages. Older learner could be expected to have equal success (or difficulty) with nouns and verbs from a morphological perspective. Thus, relative difficulty in learning verbs as compared to nouns across ages indicates that additional factors, such as semantic complexity also must contribute to the advantage in noun learning.

Other proposals favor a conceptual/perceptual basis to explain the noun advantage (Gentner, 1978; MacNamara, 1982; Maratsos, 1988). Concepts to which nouns refer are easier and more accessible than the concepts which verbs refer to (Gentner, 1978; Gopnik

& Meltzoff, 1986). Investigations involving verb learning have shown that whereas some verbs are learned and generalized in terms of similar manner, others require similarity in result of the action. Children, thus, have an additional task of choosing a relevant semantic aspect of the verb to attend to and also extract that information to generalize it in other contexts. Nouns on the other hand offer stability of form and semantic features across contexts (Gentner, 1982; Tomasello, 1992). Since the ability to encode semantic features has been shown to be strongly correlated to the ability to learn novel words (Alt et al., 2004), semantic complexity in learning verbs supports the conceptual basis of noun advantage. Thus, from a semantic perspective, verbs are inherently more complex and abstract to encode than nouns (Clark 1993).

Some pragmatic explanations to this pattern of learning have also been offered by researchers. Tomasello (1992) shows that verb learning may be especially difficult for early word learners because adults use verbs in a variety of pragmatic situations such as regulating the child's behavior, or commenting on completed actions. The diversity in these contexts can lend itself to making verb learning harder than nouns. Nouns on the other hand remain perceptually unchanged in multiple contexts. Moreover, it has been shown that children follow eye gaze and pointing as a helpful tool to learn novel lexical items. These cues are perceptually more strongly connected to objects than actions. Thus, nouns enjoy the privilege of ostensive teaching significantly more than verbs making them easier to learn.

Thus, whereas some researchers attribute noun advantage to the low variability of the morphological information attached to them as compared to the verbs, others explain it by the perceptual and semantic ease of objects over actions and yet others indicate the pragmatic and phonological basis of the pattern of findings. It seems likely, though, that learners exploit information from all the sources and the conceptual and linguistic factors may contribute at different points in the lexical development.

Word learning in adults with typical language

Word learning has been investigated sparsely in adults. Only a few studies have examined this issue, and all indicate similarity in the lexical acquisition process both in early years and adulthood (Gillette, Gleitman, Gleitman & Lederer, 1999; Marinellie & Chan, 2006; Storkel, Armbruster & Hogan, 2006; Vouloumanos, 2008). The frequency of a word in the native language affects learning of that word for both children and adults (Marinellie & Chan, 2006; Marinellie & Johnson, 2003). Marinellie and Chan (2006) investigated the ability of children and of adults to describe nouns and verbs that occur frequently or infrequently in their language. The participants were asked to write definitions and rate their familiarity with the words. The definitions for both nouns and verbs were coded for use of critical attributes of meaning, class terms, and completeness of the definition. The results show that certain types of descriptions such as attributes and class terms were easier for high frequency words than low frequency words for both groups (Marinellie & Chan, 2006).

There is also considerable consistency in the strategies that both children and adults adopt to learn novel mappings between the phonetic form and corresponding referents. The cues in environmental input and the ability to do statistical computations in children and adults contribute to their novel word learning (Graf Estes, Evans, Alibali, Saffran, 2007; Mirman, Magnuson, Graf Estes & Dixon, 2008; Swingley, 2003; Vouloumanos, 2008). Thus, an innate ability to analyze the co-occurrence of objects and words assists learners in linking referents to words in the lexical acquisition process. Vouloumanos (2008) presented adult participants with 12 word-object pairs 10 times each such that one group of objects co-occurred with the same word at all instances and other objects co-occurred with different words at different frequencies. For example, an object O1 co-occurred only with the word W1, but the object O2 co-occurred with the word W2 eight times and with the word W3 and W4 one time each. There were five levels of co-occurrence, 10, 8, 6, 2 and 1. The participants were then shown two objects on a computer screen and one word was played. The participants had to choose the object that matched the word. Word learning was tested in two forced choice designs. First, when only one correct response was possible (the word had co-occurred with only one of the objects, 10:0 co-occurrence) and the second when two correct responses were possible but one was more likely than the other (the word had co-occurred with one object 8 times and the other object 1 time, 8:1 co-occurrence). Adults chose the object that co-occurred more number of times with the word. This shows that the adults also detect patterns in the input and this ability helps in the lexical acquisition process (Vouloumanos, 2008).

Adults perform similar computations and pattern recognition word learning at the sentence level as well. In other words, adults observe the word positioning relative to other words across sentences to get important information related to the word, such as its grammatical class. According to the syntactic bootstrapping proposal of word learning, a novel lexical item is acquired by relying on the structural features of the language. Gillette et al. (1999) investigated syntactic bootstrapping to explain why nouns are learned more easily relative to verbs by adults via a simulation experiment. Gillette et al. (1999 argued against the idea that conceptual cues exclusively contributed to why nouns are learned prior to verbs. They sought to show that learning verbs requires syntactic information to be present in the sentences whereas noun learning can be accomplished to some extent simply by word-to-world mapping. Gillette et al. (1999) videotaped mother-child conversations. They initially presented learners with a version of the video in which the audio was removed. This video showed interactions between a mother and child in which 24 of the most frequent nouns and verbs were used. A beep occurred at the time the mother uttered the target noun and the target verb. Participants were asked to guess the word uttered by the mother based on the video. Participants performed more accurately on nouns as compared to verbs in the silent videotape condition where no syntactic cue was provided. Performance in this condition as well as additional experimental learning conditions increased as more syntactic information surrounding verbs was provided to the participants. Moreover, the authors argued that mapping using conceptual cues alone, in the absence of other cues (e.g., syntactic cues) allows for learning o only a limited number words, even for the noun category. They specifically showed that adults require information at the clause level to learn novel verbs (Gillette et al., 1999).

The investigations conducted with adult participants suggest that word learning in adulthood requires cues about the semantic and grammatical class of words available in the input. The investigations also show that adult learners have the ability to analyze this input. Like children, adults also learn new words by observing its position relative to other components in the sentence. In addition, judgments about the new words are made by attention to the cross situational commonalities. Despite the similarities in the process of word learning in children and adults, there is some evidence of contrary effects of input in the two age groups as well. Storkel et al. (2006) contrasted the phonotactic probability and neighborhood density of input items and showed that both of these factors influenced different aspects of word learning including the formation of an initial representation and the integration of new and the existing representations in children as well as adults. In contrast to previous findings with children, adult participants in their study showed a high phonotactic probability disadvantage. This means that whereas children have been shown to learn words with high phonotactic probability more easily than those with low phonotactic probability, adults learn the low probability words more easily. Storkel et al. (2006) hypothesize that high probability words, due to their similarity to the known sound sequences, did not trigger learning as readily as did the words with low phonotactic probability. This finding sheds light on an important difference in the way phonological cues affect the word learning process in children and adults. Children learn words with similar phonotactic properties as the words in their vocabulary more easily whereas adults show the opposite effect. Adults tend to learn words that have phonotactic properties dissimilar to the words in their vocabulary more easily. Despite the nature of the effect, the findings suggest that there *is* a strong effect of characteristics of input on language learning by adults and children. Language learners in adulthood too engage in computation of components in input language to learn the linguistic information about a novel word, i.e., information about the meaning of the word and the grammatical class of the word.

Word learning in the context of language impairment

Specific language impairment refers to a developmental disorder in which children have difficulty learning language in the absence of frank neurological, hearing, emotional, or nonverbal intellectual impairments (Leonard, 1998; Tomblin, Records, & Zhang, 1996). Children with specific language impairment have poor language skills as compared to normal language learners (Alt, Plante, & Creusere, 2004; Gray, 2003; Kiernan & Gray, 1998; Rice, Oetting, Marquis, Bode, & Pae, 1994; Rice, Buhr, & Oetting, 1992). This deficit is present in various stages of lexical acquisition including both fast mapping (Dollaghan, 1987; Ellis Weismer & Hesketh, 1996; Rice, Buhr & Nemeth, 1990) and slow mapping (Rice et al., 1992; Rice et al., 1994). A common indicator of SLI is a delay in lexical acquisition and subsequently poor vocabulary as compared to their normal peers. Several experimental studies have shown that in novel word learning tasks, performance of children with SLI is significantly poorer when compared to their peers (Dollaghan, 1987; Ellis Weismer & Hesketh, 1996; Ellis Weismer & Hesketh, 1993; Oetting, Rice, & Swank, 1995; Rice et. al., 1994). Moreover, various aspects of word learning are compromised in children with SLI: naming (Lahey & Edwards, 1996; Leonard, Nippold, Kail, & Hale, 1983); word recognition (Edwards & Lahey, 1996). Accuracy of children with SLI in naming novel words is lower than their typically developing peers. The errors include phonological (Lahey & Edwards, 1999) and semantic errors (McGregor & Appel, 2002; McGregor, Newman, Reilly, & Capone, 2002).

Researchers have considered a myriad of possible reasons that might explain the word-learning problem in children with SLI. As previously discussed, word learning involves knowledge of phonological, semantic, syntactic and pragmatic components of language. Therefore, it is not surprising that many investigations have attempted to trace a difficulty in one or more of these areas as the basis of impaired lexical processing in this population. Some of the early accounts of word learning difficulties in children with SLI have focused on a specific area of difficulty whereas others have explored a compromised non-verbal ability at the root of novel lexical acquisition problem.

van der Lely and colleagues have repeatedly presented a case for the domain specific impairment in children with SLI. The main premise of this view is that a dedicated neural circuitry serves language function and children with SLI exhibit lexical acquisition problems primarily due to an impaired grammatical system (Rice & Wexler, 1996; van der Lely, Rosen & McClelland, 1998; van der Lely, 1998; van der Lely & Stollwerck, 1997; van der Lely & Ullman, 1996). Results of these investigations suggest that core deficits in SLI are grammar specific, such as difficulty in tense and agreement marking, and other deficits stem out of these grammatical shortcomings.

Other domain specific accounts have targeted the diminished ability of children with language impairment to store phonological form of unfamiliar words for short periods of time as the basis of their language processing difficulties. Gathercole and colleagues, for example, have shown that poor phonological short term memory in children with SLI leads to incomplete representations of sound structure of an unfamiliar lexical item. Using a non-word repetition as a measure of phonological short term memory (STM), this group of researchers demonstrated that a child's ability to retain the phonological form for short periods of time was positively correlated to his ability to learn novel words (Gathercole, Hitch, Service, & Martin, 1997). Children with poor phonological STM have also been shown to have poorer native language vocabulary than those who perform better on the phonological STM tasks and poor native language vocabulary can affect the word learning ability (Gathercole & Adams, 1993, 1994; Gathercole & Baddeley, 1989; Gathercole, Willis, & Baddeley, 1991; Michas & Henry, 1994). These findings, however, have been extended to suggest that a shortcoming in short-term memory in the verbal domain, but not in other domains such as visuo-spatial domains, is responsible for lexical acquisition deficits in children with SLI (Archibald & Gathercole, 2006). Another set of findings in the domain specific view suggests that children with language impairment have difficulty processing rapidly changing acoustic cues in a speech signal (Merzenich, Jenkins, Johnston, Schreiner, Miller, & Tallal, 1996; Tallal & Piercy, 1973, 1974).

Investigations in the domain specific research identify a particular area of difficulty as the core difficulty in children with SLI. However, the findings from these investigations as a group show that there are multiple areas of concern and a single deficit in unlikely the cause for language difficulties in these children. Predictions stating that these specific difficulties confined to the linguistic domain cause lexical and other language impairment have been challenged by investigators supporting the domain-general view. Supporters of a general processing deficit provide the alternate explanation of what causes SLI and affects language-processing ability in these children (Alt & Plante, 2006; Bishop, 1997; Ellis Weismer, Evans, & Hesketh, 1999; Ellis Weismer & Evans, 2002, Elman et.al., 1996; Joanisse & Seidenberg, 1998; Karmiloff-Smith, 1998; Kushnir & Blake, 1996; Leonard, 1998; Leonard, Bortolini, Caselli, McGregor, and Sabbadini, 1992; Leonard, Eyer, Bedore, and Grela, 1997; Marton and Schwartz, 2003; Miller, Kail, Leonard & Tomblin, 2001; Spaulding, Plante & Vance, 2008). Some support for the underlying domain general non-verbal processes engaged in language learning comes from findings that children with SLI have difficulty in processing not only linguistic but non linguistic stimuli as well (Johnston & Ellis Weismer, 1983; Miller et al., 2001; Windsor & Hwang, 1999). Additional support for this perspective comes from language experiments that show that low frequency native language words are better learned than high frequency words (Jusczyk et. al., 1994). Moreover, children with SLI exhibit greater difficulty in acquiring non-words with low phonotactic probability as compared to the typically developing children of the same age

(Storkel & Rogers, 2000; Storkel, 2003).

The linguistic trade-offs in high-demand tasks are also evident in language breakdown such as word omission, morphological omission and production errors in tasks with high semantic, morphological and/or syntactic complexity (Namazi & Johnston, 1996; Nelson, Kamhi & Apel, 1987; Panagos & Prelock, 1982). Thus, tasks with greater linguistic complexity are more challenging for individuals with language difficulty than their typical peers. As the complexity increases the difference between the performances of the two groups becomes more pronounced (Dollaghan, 1987; Gray, 2003; Rice, Buhr & Nemeth, 1990). For example, decreasing the rate of presentation and increasing the number of exposures can potentially change the pattern of performance of individuals with language difficulties. There is evidence that children with SLI map one to four labels as well as their normal language peers (Dollaghan, 1987; Gray, 2003), but map fewer items when the number of labels to be learned is twenty (Rice, Buhr & Nemeth, 1990). In addition to the effect of number of labels, Rice and colleagues have also found robust effect of the number of exposures in word learning tasks (Rice et al., 1994). Perceptual salience of words manipulated by increasing the stress and spacing words also assists children with language impairment in learning words more easily (Ellis Weismer & Hesketh, 1993, 1998; Riches, Tomasello & Conti-Ramsden, 2005; Rice et al., 1992). Although, manipulations to reduce processing effort successfully make language tasks easier for children with SLI, a difficulty in learning language and new words in this group is unequivocal.

Language impairment and resulting difficulties in word learning exist in those with learning disabilities (LD) as well (Gerber & Reiff, 1994). Learning disabilities have been described as a heterogeneous group of disorders that affects multiple areas such as the ability to acquire and employ language and analytical skills including reading, listening, reasoning and math skills (Gerber & Reiff, 1994; National Adult Literacy and Learning Disability Center, 1995; National Center for Learning Disabilities, 1997). Gibbs and Cooper (1989) documented the prevalence of communicative disorders in over 200 participants who had LD. Participants were chosen in three phases. Phase 1 included an initial referral. Phase 2 included assessment of intelligence (Wechsler Intelligence Scale for Children Revised – WISC-R; Wechsler, 1974), vision, and hearing and diagnostic language achievement as well as teacher observation. Phase 3 included a final decision of LD status by individualized education program development. The authors reported that 96 percent of participants had at least one type of communicative disorder including fluency (Fluency Assessment Digest for Children; Cooper & Cooper, 1983), articulation (Test of minimal articulation competence; Secord, 1981), voice (Boone, 1971), and language (TOLD-I; Hammil & Newcomer, 1982). The number of participants with voice, articulation, fluency and hearing deficits ranged from 1 to 24 percent whereas those with only language problems including comprehension was 90 percent. A primary area of difficulty in individuals with LD is reading comprehension (Kayale & Reece, 1992). Moreover, poor language skills in this group also affect reading comprehension (Siegel, 1993; Stanovich & Siegel, 1994). Language-based difficulties that impact reading include difficulty in phonological decoding, poor vocabulary, difficulty in processing syntax and morphological inflections (Dickinson & Tabors, 2001; Snow & Tabors, 1993; Vellutino, 1979; Vellutino & Scanlon, 1987). Wittrock and colleagues have reported that performance of children on text comprehension measures was decreased when one out of six substance words was replaced by an unfamiliar synonym (Marks, Doctorow, & Wittrock, 1974; Wittrock, Marks, & Doctorow, 1975). This shows the effect of word familiarity on reading comprehension. High correlations between vocabulary and reading comprehension have also been reported by other researchers (Tannenbaum, Torgesen & Wagner, 2006).

The interdependence of vocabulary deficits and reading comprehension difficulties is evident in adults as well (Vellutino, Scanlon & Spearing, 1995). Due to poor vocabulary, individuals with LD are expected to have a higher probability of encountering unfamiliar words during reading than their typical peers. Vellutino, Scanlon and Spearing (1995) showed that relatively less familiar words were read more poorly than more familiar words by typical as well as LD adults. Reading a text with difficulty can make these adults with LD unmotivated readers and lead to a low enjoyment of reading. Since reading is the most common way for adults to acquire new vocabulary (Nagy & Anderson, 1984), a reduced amount of reading leaves fewer opportunities for these individuals to encounter and learn new words. Moreover, text reading provides knowledge of language components that aid word learning. For example, frequent readers get exposed to a greater variety of syntactic frames and are therefore better prepared to use syntactic cues, such as word order, during word learning (Hall, Waxman, & Hurwitz, 1993; Mintz & Gleitman, 2002). Thus, effect of language abilities on reading comprehension is bidirectional. In other words, language abilities influence reading comprehension and reading comprehension can indirectly affect the opportunities of adults to hone language skills. In addition, both language and reading abilities have a direct impact on word learning abilities. Adults with LD have difficulties in both, which puts them at a risk of being poor word learners.

Although the primary difficulty in adults with LD is language, these individuals may also have co-morbid deficits in non-verbal skills as well. Alt and Gutmann (2009) showed that adults with a history of spoken and written language in addition to ADHD performed significantly poorly on fast mapping task as compared to those who did not have ADHD. This suggests that non verbal skills such as attention can affect word learning performance.

The aim of the present study was to examine word learning in adults. Word learning, as discussed, is affected by the characteristics of the input and ability of the learner to process these characteristics. Examining this area is an important task because adults with and without LD may be engaged in reading, classroom activities, professional conversations, and other social interactions in which new words are encountered. Individuals with LD have a variety of difficulties with language processing (Runyan, 1991; Swanson, 1992; Swanson & Alexander, 1997; Stanovich, 1986) that are likely to impact word learning. Chapter 2 provides a rationale for conducted the present study.

CHAPTER 2: THE PRESENT STUDY

Learning new words involves processing information about the phonological, syntactic, semantic, and pragmatic information associated with that word. Both children and adults are capable of extracting information about new words from each of these language domains. For example, learners attend to the distributional properties of the phonological components of language in the input to make decisions about word boundaries and identify individual words in a speech stream (Mattys & Jusczyk, 2001; Mattys, Jusczyk, Luce, & Morgan, 1999). The same skills are employed at the syntactic level and semantic levels as well in order to access the grammatical information and meaning attached to the word (Alt, Plante & Creusere, 2004; Alt & Plante, 2006; Hall, Waxman, & Hurwitz, 1993; Mintz & Gleitman, 2002; Taylor & Gelman, 1988). Moreover, children also use pragmatic skills such as joint attention and following eye gaze to learn new words (Baldwin, 1993; Baldwin, Markman, Bill, Desjardins, Irwin & Tidball, 1996).

Factors affecting word learning

Exposure. There is ample evidence in the literature suggesting a facilitative effect of the amount of *exposure* to new words on learning. Jenkins et. al. (1984) demonstrated that words are learned incidentally through reading text passages. Moreover, they also showed that words were learned better when presented ten times as compared to two times. Thus, learning is accelerated when the words are encountered frequently (Jenkins, Stein & Wyoski, 1984; van Daalen-Kapteijns, Elshout-Mohr, & de Glopper, 2001). Understanding of the meaning of new words is incremental and gains are made with each new encounter with the word (Fukkink, Blok, & de Glopper, 2001; Jenkins et al. 1984; Nagy, Anderson, & Herman, 1987; Nagy, Herman, & Anderson, 1985). Perfetti, Wlotko, and Hart (2005) proposed that when adults encounter new words in a narrative context, multiple associated aspects of the word, such as phonology, semantics, and morphology, are represented in memory. However, the early word meanings are fragile and incomplete (Elshout-Mohr & van Daalen-Kapteijns, 1987; Jenkins et al. 1984; van Daalen-Kapteijns & Elshout-Mohr, 1981). Meanings are better represented and solidified through the process of repeated experience with the word (Zahar, Cobb, & Spada, 2001). Reichle and Perfetti (2003) have shown that multiple exposures to words make their representations stronger, more independent and more complete in terms of phonological, semantic, and orthographic information.

The effect of frequency on word learning has often been examined by repeatedly presenting the same text, containing a target word to be learned, to participants (Nagy, Herman & Anderson, 1985; Reichle & Perfetti, 2003). In natural learning situations, however, learners frequently encounter new vocabulary in different texts and in a variety of surrounding sentences. This variation in the sentences surrounding the new vocabulary item can offer new perspectives on the meaning of these words. In addition, increased variety of sentences can add rich syntactic cues for interpreting the grammatical class of the new word. For example, an unknown noun can be recognized as a noun by virtue of being preceded by an article or adjective. However, every sentence containing a noun may not necessarily provide this cue. The probability of this syntactic cue increases with the variety of sentences in which the noun is encountered. Therefore, providing multiple and linguistically varied contexts may support word learning in an experimental task.

Grammatical class. In addition to the effect linked to the frequency of presentation, there is evidence that the *grammatical class* of the word also influences learning. Adults with typical language skills learn nouns more easily than verbs. Some researchers propose that this is because noun learning is easier due to less variability in morphological form, whereas others suggest that a more concrete semantic reference of nouns as compared to verbs is the basis of ease in learning nouns (see the extended discussion in Chapter 1, Grammatical Class Effects). Despite this debate, it is commonly held that words in different grammatical classes have different levels of complexity. Furthermore, this difference in complexity is thought to drive the variation in learning these words (Bedore & Leonard, 2000; Gentner, 1978; Leonard et. al., 1992; Macnamara, 1982).

Grouping words in syntactic categories is an important part of word learning (Bloom, 1970). Newly encountered words are assigned grammatical roles based on their usage within spoken utterances or printed text. Morphological inflections are one of the many clues that are used to group words belonging to the same category (e.g., nouns vs. verbs, regular vs. irregular) (Wilson, Gerken & Nicol, 2000). Verbs have a greater variety of morphological forms as compared to nouns. For example, a verb like 'kick' exists in four different forms, namely, 'kicked', 'kicking', 'kicks', and 'kick'. On the other hand, nouns have only two morphological forms: 'cat' and 'cats'. The greater variability of morphological forms may make it more difficult and time consuming to form a category representation for verbs. Moreover, irregular verbs like 'sleep' have a different form in past tense, namely, 'slept' instead of 'sleeped'. Despite these differences (kicked and slept), irregular verbs are used in similar syntactic frames as the regular verbs (example, 'he kicked fitfully'; 'he slept fitfully'). Therefore, in the word learning process, the learner must recognize that different lexical items with different affixes may nonetheless denote the same grammatical class (verbs) and tense (example, slept and kicked). On the other hand, nouns occur in only 2 forms – the plural form with the inflection '-s' (dogs) and the singular form with no inflection attached to the word (dog). The judgment about this class of words may therefore be made more easily and more quickly than for verbs.

Verb *referents* are also more complex to encode. These words encode real-world referents that are more transient or abstract as compared to noun referents. For example, the verb 'clap' refers to the action of the changing movement of the hands. It is easier for the learner to encode the stable and perceivable characteristics of the person who is clapping. However, it can be harder to build a strong mental representation of the action of clapping due to transient nature of the defining movement characteristics. In addition, actions often produce an effect, for example, the act of clapping produces a sound, which is also part of the word's semantic representation. Therefore, developing a conceptual representation for verb meanings can be challenging by the very nature of the referents these words encode (Gentner, 1978).

The grammatical class effect has been studied in children with and without SLI and in adults with typical language (Alt & Plante, 2004; Leonard et.al., 1992; Oetting et al., 1995; Rice et al., 1990; Rice et al., 1995; Rice & Wexler, 1996). Although, it is not known if the grammatical class affects word learning in adults with LD, we may reasonably expect a similar effect for this population as well due to the inherent complexity of verbs compared to nouns. Despite the strong basis for this prediction, it is not known how the factors associated with maturation (such as increased language experience) may or may not affect the ability to learn different words in adults with LD. If their learning pattern reflects a less mature language system, it may be that the grammatical class effect is more pronounced for these adults than for adult with typical language. Moreover, it is important to examine this effect because empirical evidence of this effect in adults with LD may influence the instructional strategies for these individuals in various educational settings.

Reading as a modality for word learning

In addition to the semantic characteristics and grammatical class of the words, the modality in which words are presented also influences learning. Nelson, Balass and Perfetti (2005) have shown that visual presentation of words provides an advantage for learning over auditory presentation for adults. Dean and colleagues have also demonstrated that retention of visually presented words is better than retention of auditorily presented words (Dean, Yekovich, and Gray, 1988; Gallo, McDermott, Percer, and Roediger, 2001). It has also been proposed that phonological recoding of orthography (the translation of written language into phonological form) happens more readily than orthographic recoding of a phonological stimulus (the translation of an auditory input into written form) (Nelson, Balass & Perfetti, 2005). Likewise, there is more variability in the phonological representations than orthographic representations of a word (Borowsky, Owen, & Fonos, 1999; Dean et. al., 1988). Therefore, reading as a modality for word learning offers advantages that should facilitate learning compared to auditory contexts.

The reading modality advantage may not be as strong for certain sub-populations of adults. For example, despite differences in how learning disability is defined in the research literature (Kavale, Forness, & Lorsbach, 1991; Mercer, King-Sears, & Mercer, 1990), one common finding is that children and adults with LD have problems in learning to read (Kavale & Reece, 1992). Although most of the investigations in learning disability have focused on adults who have dyslexia, there is evidence of reading difficulties in adults with other types of learning disabilities (e.g., learning disability associated with poor language comprehension) as well (Denckla & Rudel, 1976; Runyan, 1991; Stanovich, 1986; Swanson, Ashbaker, & Sachse- Lee, 1996; Swanson & Sachse-Lee, 2001). The primary reading difficulty in the dyslexic population has often been attributed to problems in *decoding* (i.e., an impairment in identifying the sounds that correspond to letters and words). Children and adults who have other forms of learning disabilities may present with difficulties in reading *comprehension* (i.e., an impairment in understanding the meaning of what is read) (Runyan, 1991; Swanson, 1992; Swanson & Alexander, 1997; Stanovich, 1986).

Word learning in a reading context is predicated on comprehension of the text in which the words are embedded. Meyer, Brandt, and Bluth (1980) demonstrated that reading comprehension is dependent on the knowledge of text structure, which is impaired in students with LD. These students tend to read without a “plan of action”. In other words, students with LD are less able to read and retrieve information in an organized way, but tend instead to do it randomly.

Poor reading comprehension in adults with LD may lead to lack of motivation to read and consequently less amount of reading (Cunningham & Stanovich, 1998; Stanovich & West, 1989). Less reading corresponds to less opportunity to explore the phonological, morphological, semantic, and syntactic characteristics of the language and to encounter new vocabulary in text (Baumann & Kameenui, 1991; Nagy & Anderson, 1984; Paul & O'Rourke, 1988; Stanovich, 1986). Since reading accounts for the majority of new vocabulary acquisition in adults (Nagy & Anderson, 1984), impairment in reading comprehension can affect word learning abilities in adults with LD. Therefore examining word learning via reading is an important first step to identify and understand this deficit in adults with LD.

The present study

The present study examined aspects of word learning in the context of text reading. Reading was chosen as the experimental context in order to target a common modality for word learning (Elivian, 1938; Jenkins et al. 1984; Hafner, 1932; Nagy and Anderson, 1984). As discussed above, adults with LD can have reading comprehension difficulties due to both language impairment and co-morbid nonverbal deficits (Swanson & Alexander, 1997). Problems with comprehension can be overcome to some extent by adults with LD if they are given extra time to process the material (Runyan, 1991). In the present study, there was no time limit in which to read the material. Therefore, an effect of slow reading per se was not expected to interfere in word learning performance. Furthermore, a reading context provides an opportunity for the reader to review information in order to improve understanding. This flexibility is not offered by auditory learning. Thus, the permanence of written text should assist processing compared to word learning in the auditory modality. A problem in decoding during reading can interfere with word learning. Decoding refers to the ability to judge letter to sound correspondence. Difficulty in sounding out letters can make it hard to recognize and read words. Poor word recognition can make the word learning process slow and effortful. Adults with LD can have decoding difficulties (Denckla & Rudel, 1976). When decoding deficits occur, they may interfere with the word learning.

Even with the advantages of a reading context, word learning during reading may still be challenging to adults with LD. This is because language comprehension difficulties in this group may impair reading comprehension even if the individual is applying comprehension enhancing strategies. Therefore, adults with LD may be less able to glean information about new words from the surrounding linguistic context, even when it has the permanence of printed text.

Although reading was selected as the context for word learning, an oral rather than written response modality was used for two reasons. First, oral language is a widely employed modality for word retrieval and usage. Adults often are expected to use vocabulary in spoken contexts such as conversations, interviews, conferences, and classroom activities. Therefore, the combination of written input paired with oral language use is intended to target the nature of word learning and subsequent use common to real life situations (i.e, learning through reading and using the newly learned words orally). A second reason for choosing an oral response relates to the reported difficulty that individuals with learning disability have in written modality (Englert, Raphael, Anderson, Anthony, & Stevens, 1991; Graham & Harris, 1997). Some researchers have compared the written and oral modality in a story production task in students with LD (Scott & Windsor, 2000). Scott and Windsor (2000) found that the written modality is more taxing than the oral modality for these individuals. Students with LD generated shorter written summaries of stories presented to them and had more errors in their summaries in the written modality as compared to oral response. An oral response from this population was, therefore, considered to be more appropriate for the present experiment.

This study was designed to achieve the following objectives: First, it sought to document the word learning differences in adults with and without LD. Younger children with impaired language have poor word learning skills compared to their typical peers. Adults with LD have experience and a more mature language system than children with

SLI. . More experience may lead to improved overall word learning ability relative to children. This experience may have also bridged the gap between learning nouns and verbs. However, it is known that the language processing abilities that support word learning are significantly poor in adults with LD as compared to their typical peers. On this basis, it is predicted that the two groups will have word learning differences. Second, it was designed to examine the effects of grammatical class on the learning of words using a novel word learning paradigm in a reading context. The language difficulties in adults with LD can make the verbs harder to learn as verb learning requires greater linguistic support. The third aim was to explore the effects of increasing experience with the words on learning of the novel words. Lastly, it sought to examine the effect of interactions between the main variables of the study (group, word type and time) on word learning.

The hypotheses under study included:

1. **Adults with learning disability (LD) will exhibit poor learning of novel words relative to typical language (NL) peers.** The basis for this hypothesis was the existing findings of poor word learning in other language impaired populations (i.e., children with SLI). I expect similar findings in a reading context, given poor reading comprehension skills in adults with LD.

2. **Performance of the two groups will be better overall on nouns than on verbs.**

This hypothesis is based on the follows from similar findings in typical children and adults as well as children with SLI. I expect nouns to be better learned than verbs because of the higher processing demands associated with verb learning.

3**. Performance will improve across time as a result of increasing experience provided for the words.** This prediction is supported by the facilitative effects of increased exposure to words in learning of new forms. I expect that increasing exposure to words in context will increase knowledge of the nature of the word's grammatical role and meaning contributing to the overall learning of the novel word.

4. **The difference in performance of adults with and without LD will be greater on verbs than nouns. Moreover, LD group will show greater increase in performance across time than the NL group.** This prediction is based on the language difficulties of adults with LD. Since verb learning requires more linguistic support than nouns, a difficulty in the language will decrease verb learning performance to a greater extent than noun learning in adults with LD. On the same basis, I expect that the LD group will have greater difficulty in fast mapping words because of the restricted range of language cues. With an increase in exposure, the LD group will show higher gains in overall word learning than the NL group.

CHAPTER 3: METHODS

Participants

Two groups of adults between the ages of 18 and 35 participated in this study. One group consisted of 30 adults (18 males, 12 females) with language-based learning disability (LD) and the other group included 30 adults (15 males, 15 females) with typical language. The LD group was comprised of 23 participants with LD only and 7 additional participants also had Attention Deficit Hyperactivity Disorder (ADHD). None of the participants in the typical group had ADHD as determined by self report.

The number of participants was initially determined based on power calculations of studies completed with similar participants in our lab, to give a minimum power of .80. This was routinely checked for effect sizes and power as data collection progressed. The participants were matched for age (LD mean= 19.6, SD= 3.4; NL mean= 20.01, SD= 2.2). All were students enrolled at the University of Arizona. Four additional adults were tested but were excluded from the study because they either failed a hearing screening at the time of study, or standardized testing (described below) failed to confirm either poor or normal language skills consistent with their *a priori* group membership. Five adults with history of head trauma as reported on the survey were also excluded from the study before testing.

Subject Selection Criteria

Adults included as participants satisfied the following criteria. All participants were monolingual English speakers with normal-range hearing sensitivity as determined by audiometric pure tone screening at 25db HL at 500 Hz, 1 kHz, 2 kHz, and 4 kHz. Moreover, all participants received a standard score above 75 (70+1 S.E.M.) on the *Test of Nonverbal Intelligence— Third Edition* (TONI–III; Brown, Sherbenou & Johnsen, 1997) to ensure normal intelligence (standard score > 70 +1SEM). This criterion was used because the Diagnostic and Statistical Manual of Mental Diseases--Fourth edition sets the IQ portion of the criteria for Mental Retardation at < 70 +/- 1SEM for the test employed (DSM-IV; American Psychiatric Association, 1994). In addition to normal range hearing and IQ skills, the participants had no motor, behavior, or other neurological conditions by self report.

Group Placement

The following lines of converging evidence were used to determine whether participants were placed in the typically-developing or language impaired group: Participants in the LD group reported problems in certain areas of language whereas participants in the typically-developing group reported normal language skills in a questionnaire distributed prior to the study. To ensure that all the participants in the LD group had lower language skills as compared to their peers in the control group and to ensure that no participant in the NL group had an undiagnosed disorder, adults were tested on a battery validated by Fidler, Plante, and Vance (submitted). This battery included a modified version of the Token Test (Morice & McNicol, 1985), and a 15 word written spelling list. The means and standard deviations of the scores are given in Table 1. The results of these tests were then subjected to a discriminant analysis for participant classification on the basis of statistically weighted scores. Subtests of the *Woodcock-Johnson Psycho-educational Battery–Revised* were also administered to evaluate the reading comprehension of the participants in both groups (Word Attack to test phonetic skills, Letter Word Identification test, Passage comprehension and Reading Comprehension to test speed of reading sentences) (Woodcock & Johnson, 1989). All the participants completed the hearing, cognitive, and language assessments in the Speech, Language and Hearing Science department at the University of Arizona.

***Reliability Measures*.**

Inter-rater reliability data was collected for 15% of the subjects by having a second observer score testing during the experimental session. Point-to-point reliability was calculated (Mean = 97%; SD = 3%). Any discrepancy in responses recorded was resolved by referring to the test manual for proper scoring procedures.

Materials and Instrumentation

The stimulus for the present study was a short English story in a print format. The stories were based on Indian folk tales to reduce the likelihood of content familiarity, which could influence performance. Two nouns and two verbs in the story were replaced by non-words. Nouns and verbs were chosen to be replaced by non words to observe whether the two types of words are learned differently.

The story was divided into three sections. The first contained one occurrence of each non-word, whereas sections two and three contained three occurrences of each non-word. The single occurrence of the target words at Time 1 allowed for measuring the fast mapping. The subsequently higher number of occurrence at times 2 and 3 allowed for measuring learning after greater experience with words, as in slow mapping.

Table 1. *Means and standard deviations of LD and NL groups on behavioral measures.*

Behavioral Measures	LD		NL	
	M	SD	M	SD
Modified Token Test[a*]	32.65	6.55	41.56	2.69
Spelling[b*]	9.19	2.1	11.03	1.22
TONI-III [c*]	98.37	13.44	109.8	14.12
Letter Word Identification [c*]	102.15	12.34	111.24	14.60
Reading Fluency [c*]	91.21	4.9	112	12.11
Passage Comprehension [c*]	97.52	9.78	103.78	6.7
Word Attack [c*]	99.16	8.01	111.42	13.10

[a] Modified Token Test is reported as raw score out of a total of 44

[b] Spelling is reported as raw score out of a total of 15,

[c] Reported as standard score ($\bar{X}$ = 100 , SD = 15)

* Significantly different (t test) at $p < .05$

To control for possible idiosyncrasies in the story context, two stories and two versions of each of these stories were created (Story 1 Versions A & B; Story 2, Versions A & B). An example story is provided in Appendix A. The same nouns and verbs were replaced by non-words in both versions. However, the replacements were counterbalance so that a non-word replacing a noun in the first version was used to replace a verb in the second version and vice versa. The words were designed with comparable phonological and syntactic/semantic attributes to ensure that any difference in learning the two kinds of words was due to the inherent differences between nouns and verbs and not due to the external factors introduced by the experimental setup (Storkel, 2001; Storkel, 2003). The non-words were matched for phonotactic probability (Story 1: M = 0.2131, SD = 0.02; Story 2: M = 0.2285, SD = 0.04); phonological neighborhood density (Story 1: Range = 0-4; Story 2: Range = 0-4); orthographic probability (Story 1: M = .95, SD = 1.24; Story 2: M = .73, SD = 1.1); orthographic neighborhood density (Story 1: Range = 2-6; Story 2: Range = 2-7) and word length (2-syllable) using a web-based interface to calculate phonotactic probability and neighborhood density for non words in English (Vitevitch & Luce, 2004; Vaden, Hickok & Halpin, 2009). Moreover, the nouns and verbs were matched for their semantic and syntactic complexity on the basis of plurality, transitivity and concreteness.

Procedure

Participants were assigned one version of the two possible stories, and this assignment was counterbalanced across and within groups. Before the experiment, participants were told they would read a story and answer questions. They were informed that they would not have access to the stories during the testing phase. Then, each participant was given a story to read in three sections.

After each section of the story, the participant orally answered a set of questions based on the story. The goal for developing the test items was to target a number of aspects of word learning (e.g., grammatical class, semantics). This reflects the reality of word learning in that complete knowledge of a new word involves knowledge of both word meaning and its grammatical class. For example, knowing that the word *'cap'* is a noun without understanding what it refers to does not accomplish complete 'learning' of the word The probes in the study were designed to assess understanding of phonological, semantics, syntax and grammatical class of the word. This multifaceted testing procedure permitted me to survey multiple aspects of word knowledge gained from the reading task. Table 2 provides the instructions given for each test item type. The individual test items are provided in Appendix B. The same set of the test items were repeated after each section of the story was read. However, the order of words queried within each test item type was randomized. Inter rater reliability data was collected for 15% of the participants by a second experimenter. Point to point reliability was calculated (Mean = 97%, SD = 3%).

Data Analysis. The responses on all the test items except the synonym question were scored either 0 (incorrect) or 1 (correct). The synonym question was scored on a range of 0-3 (0- wrong answer, for example, 'chair' for pond; 1- wrong but same superordinate category response, for example ‘a place’/ ‘beach’ for ‘pond’; 2 - additional properties described, for example, ‘water dwelling’ for ‘pond’; 3- correct response). This was done to differentially credit the participants as their level of understanding of the word advanced and to distinguish between participants who did not comprehend the word, those who comprehended but did not provide specific details (suggesting partial comprehension), and those who fully comprehended the word. The scores on all the test items were combined to give a composite score. Since the aim of the study was to examine overall learning of the new words, the different types of test items were not segregated for the primary analysis. However, descriptive statistics related to the different test item types are provided.

Table 2. *Test items and instructions.*

Test items	**Instruction**
Introduction	‘Based on the story you just read, answer the following questions as best you can. Questions will not be repeated so listen carefully and then answer’
Grammatical-class judgment	‘Say whether the following word is a noun or a verb’
Grammatical judgment	‘Some of the new words you read in the story were nouns and some were verbs. Using this information decide whether the following sentences make sense. Say yes or no’
Synonym	Think of a synonym for each word. A synonym is another word with the same meaning
Repeat	‘Repeat the following words’
Blank	‘Some of the new words you read in the story were nouns and some were verbs. Using this information, fill in the blank with the word that fits best’
Question	‘Answer the following questions based on your understanding of the story’
Sentence formation	‘Use the following words in a sentence of your own’

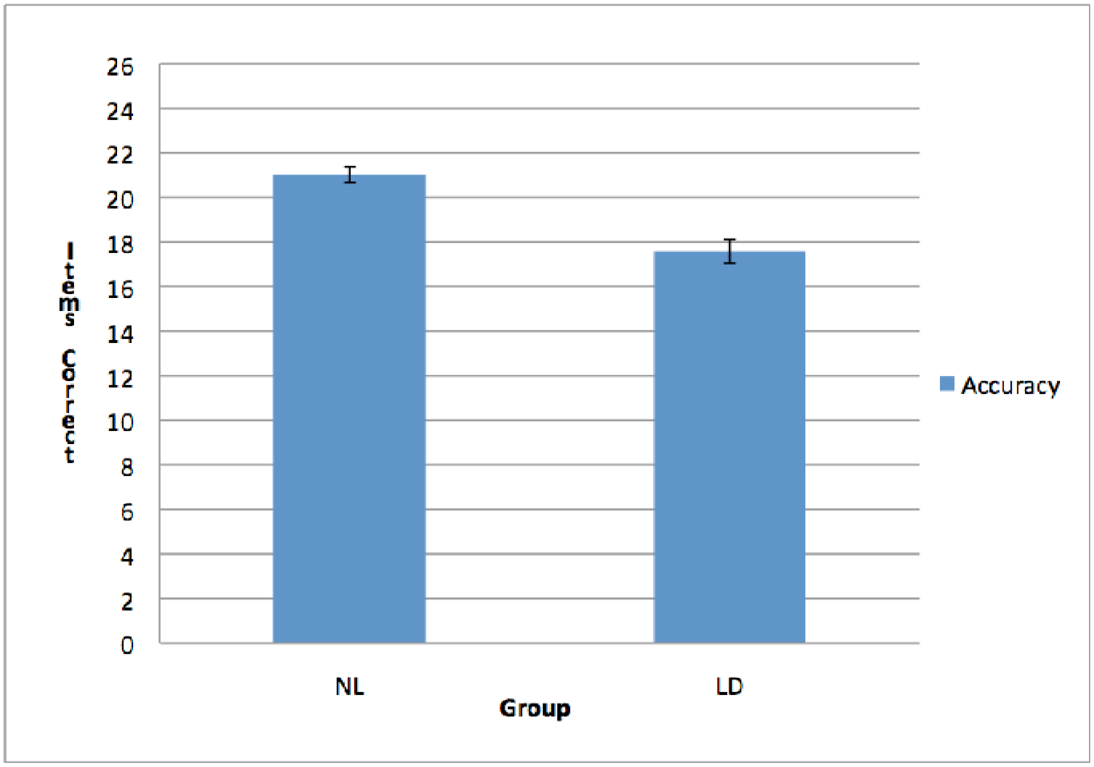
The total scores were then subject to a mixed measures ANOVA to analyze the within and between group difference in the performance on the two types of words. The within group difference on the two word types across 3 sets of test items at three different times (Time 1, Time 2, and Time 3) was also considered.

CHAPTER 4: RESULTS

The primary purpose of this study was to examine the difference between the word learning ability of adults with and without learning disability (LD and NL respectively) for two types of words, nouns and verbs. Recall that participants read the text in three parts. Performance on test items was evaluated after every section (Time 1, Time 2 and Time 3). The three time points differed in terms of the number of exposures to the novel word that had occurred as well as the amount of the accumulated contextual information participants received for these words.

For the present study, two stories were designed to ensure the validity of results. Since the task in the present study was learning new words from a story, it is possible that some characteristics (for example, phonological or semantic characteristics) of the words in one story were harder to learn than the words in the second story. It is also possible that some of the words were more ambiguous than others. Such potential differences across stories can lead to inaccurate interpretation of the results. For the same reason, data from both versions of Story 1 and Story 2 were analyzed to exclude the possibility of any confounding factors peculiar to the text. One such factor was the inclusion of the word '*fish*' in story 2. Since the word '*fish*' can act as noun as well as a verb, it posed a potential threat to the validity of the results. The probes involving the word 'fish' could have been responded according to a noun or a verb. It is possible that adults with LD who have language problems did not use linguistic cues as efficiently as their typical peers to judge the grammatical status of the word given the ambiguity. It was therefore important to see the results on the two stories separately. No difference in learning words in the two stories would ensure that any effects found in the study were indeed a result of the participants' word learning abilities and were not confounded by extraneous factors. For LD adults, the effects were as follows: Story (1 vs. 2), F (1, 27) = .6, p <0.43, $\eta^2_p = 0.02$; Story X Word Type, F (1, 27) = 0.1, p <0.97, $\eta^2_p = 0.0$; Time X Story, F (2, 56) = 1.0, p <0.37, $\eta^2_p = 0.03$;Word Type X Time X Story, F (1, 28) = .27, p <0.76, $\eta^2_p = 0.09$. For NL adults, the effects were as follows: Story (1 vs. 2) F (1, 27) = 0.02, p <0.88, $\eta^2_p = 0.26$; Story X Word Type, F (1, 28) = 0.03, p <0.86, $\eta^2_p = 0.1$; Time X Story, F (1, 56) = 0.6, p <0.54, $\eta^2_p = 0.02$; Word Type X Time X Story F (1, 28) =0.9, p <0.39, $\eta^2_p = 0.03$. This outcome suggests that the idiosyncracies of each story had no significant effect on the learning of novel words for either group of participants. Therefore, the two versions of both stories were combined for subsequent analyses.

Figure 1. Overall group difference

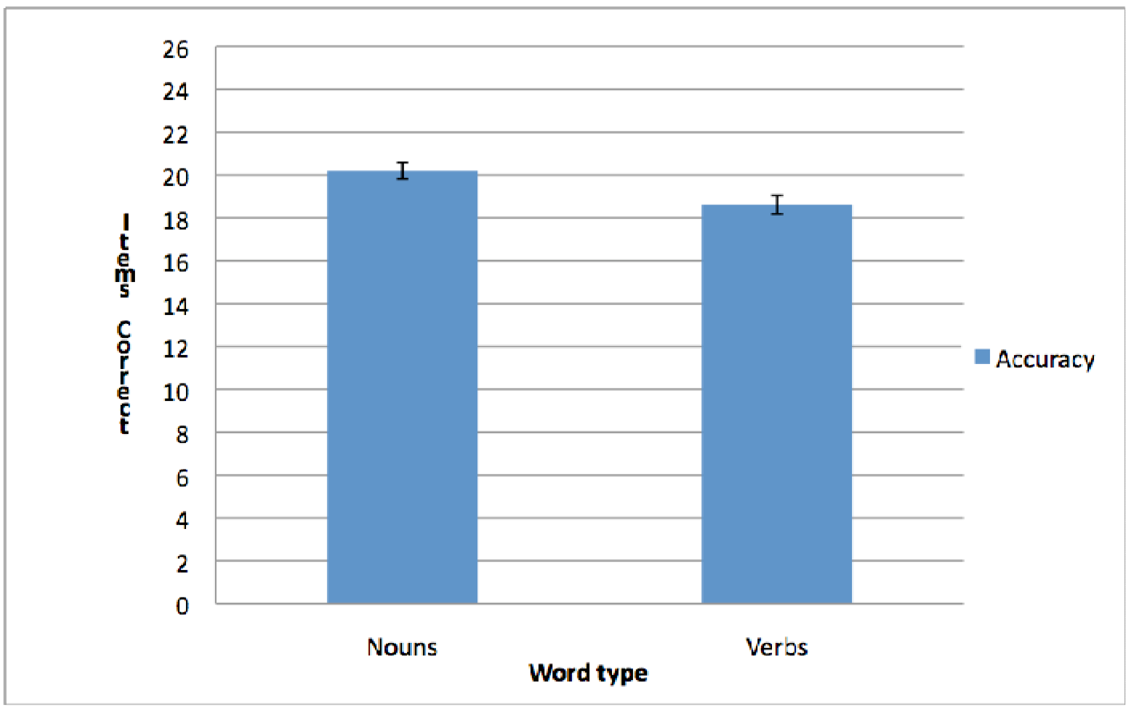


The first hypothesis was that adults with LD would exhibit poor understanding of the novel words relative to their typical language peers.

The performance of the NL and LD groups is displayed in Figure 1. The mean scores were 21.13 (SD= 4.80) for the NL group and 17.25 (SD= 5.9) for the LD group. This was out of a total of 26 possible score. The results supported this hypothesis, with a significant effect for Group (F (1, 52) = 25.02, $p < 0.0000$, $\eta^2_p = 0.32$), indicating the accuracy of the LD group was significantly lower than the control group overall.

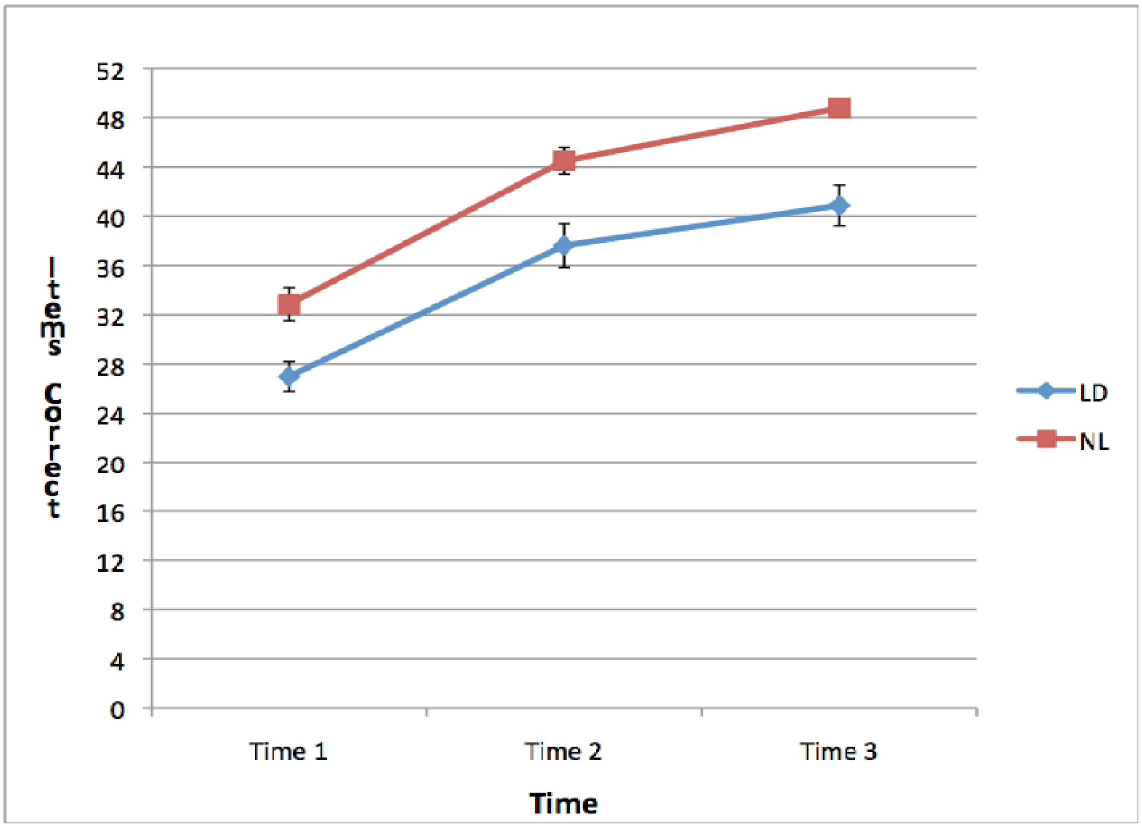
I also predicted that performance of the two groups would be better overall on nouns than on verbs. The performance on nouns and verbs is displayed in Figure 2. The mean score was 20.12 (SD=5.01) for the nouns and 18.2 (SD=5.71) for the verbs. There was a significant main effect of Word Type ($F (1, 52) = 36.8$, $p < 0.000$, $\eta^2_p = 0.41$). This effect indicated that participants exhibited better accuracy on nouns as compared to verbs.

Figure 2. Overall difference in word types



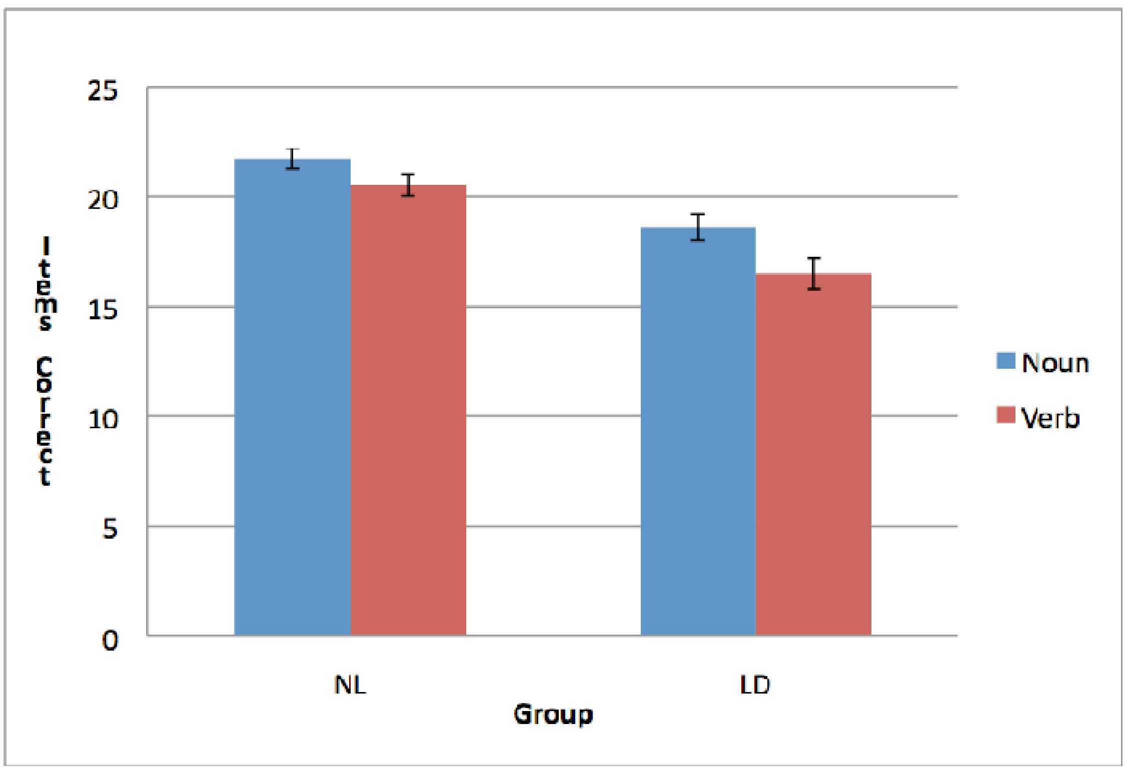
The third hypothesis was that the performance would differ across time as a result of increasing contextual information provided for the words. This was confirmed with a significant effect of Time (1, 2 and 3) at all three time points ($F (2, 104) = 164.47$, $p< 0.00$, $\eta^2_p = 0.75$). This result is illustrated in Figure 3. This result supported the hypothesis that with greater amount of exposure, understanding of the word was strengthened. The overall performance of both the groups improved over time with the accumulation of contextual cues.

Figure 3. Main effect for Time



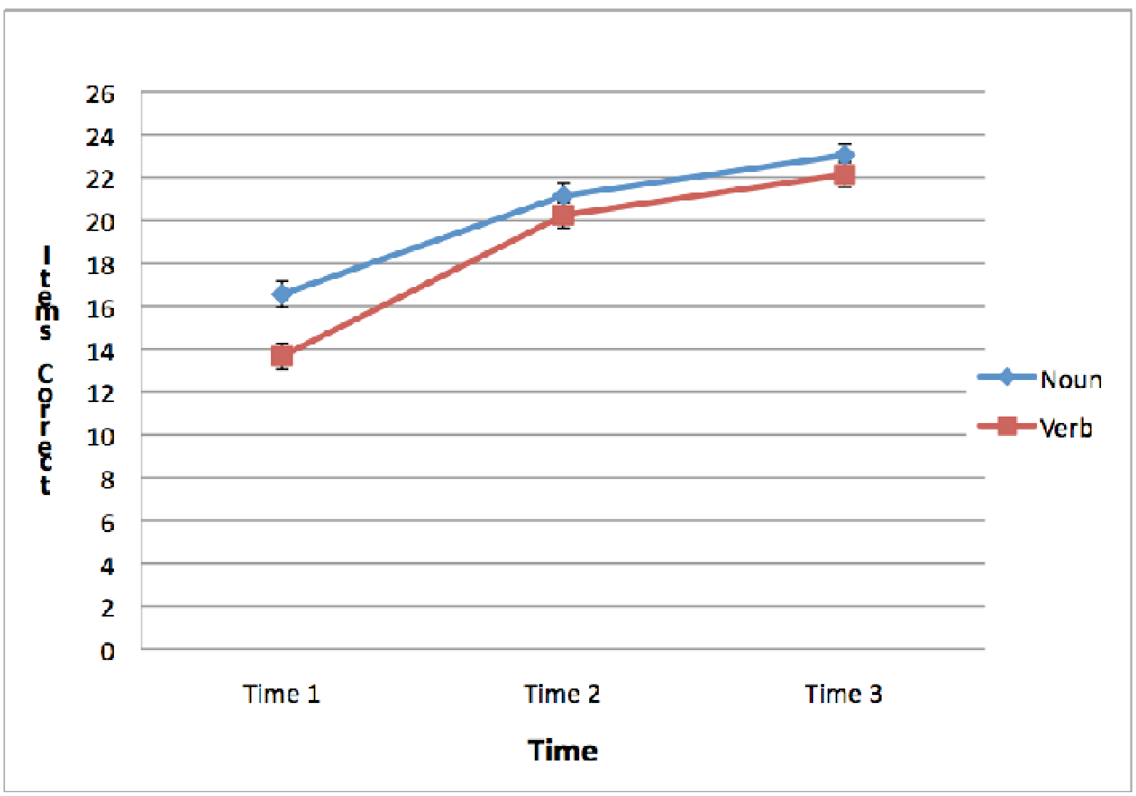
Interaction effects between these variables were also observed. Specifically, individuals with LD performed significantly worse on verbs than their typical peers. The results revealed a significant Group x Word Type interaction (F (1, 52) = 4.6, $p<$ 0.036, $\eta^2_p = 0.08$). As indicated in Figure 4, the two groups differed with respect to their relative performance on the two word types. Paired t-tests indicated there was a significant difference in the performance between the two word types by both the NL (t (1, 95) = 3.95, $p < 0.01$, $d = 0.24$) as well as the LD group (t (1, 95) = 4.10, $p < 0.001$, $d = 0.43$). These effects were significant even at an adjusted p value of .0125, used to account for multiple comparisons. Moreover, there was a significant difference between the two groups on each of the word type (Tukey HSD for nouns: $p < 0.001$, $d = 0.68$) for verbs: $p < 0.0001$, $d = 0.77$).

Figure 4. Word type and Group interaction.



The results also indicated a significant Word Type X Time interaction (F (2, 104) = 9.17, $p < 0.005$, $\eta^2_p = 0.14$). As Figure 5 indicates, the performance of the participants on the two word types differed as a function of time. There were significantly greater gains on both word types from Time 1 to 2 (Nouns: t (59,1) = 7.5, p<0.00; Verbs: t (59, 1) = 11.19, p<0.00) than from Time 2 to Time 3 (Nouns: t (59,1) – 4.54, p<0.00); Verbs: t (59, 1) = 4.88, p<0.00), suggesting a greater amount of learning in the earlier two sections of the written passage than for the last section. Moreover, due to the lower performance on verbs relative to nouns at Time 1, the early gains for this word type were significantly greater than for nouns.

Figure 5. Word type and Time interaction.



There was no significant Group x Time effect ($F (2, 90) = 1.8$, $p< 0.179$, $\eta^2_p = 0.03$). The performance of both groups showed a similar learning curve from Time 1 to 3. Likewise, there was no three way interaction between group, word type and time ($F (2, 90) = 0.65$, $p < 0.52$, $\eta^2_p = 0.01$). See Figure 6 for the interaction effect for Nouns and Figure 7 for Verbs.

Word learning abilities of adults with LD only may differ from adults who have both LD and ADHD (Alt & Gutmann, 2009), therefore a second analysis in which only the individuals in the LD group who did not also have ADHD were compared to the typical group. The analyses showed results similar to the original analysis. There was a significant Group effect: $F (1,51) = 23.51$ $p <0.01$, $\eta^2_p = 0.32$; Word Type effect: $F (1, 51) = 16.9$, $p <0.01$, $\eta^2_p = 0.24$; Time effect: $F (1, 51)) = 21.1$, $p <0.01$, $\eta^2_p = 0.29$; Word Type X Group $F (1, 51) = 4.4$, $p <0.03$, $\eta^2_p = 0.08$; Word Type X Time $F (1, 51) = 177.3$, $p <0.01$, $\eta^2_p = 0.77$. There was no Time X Group effect and no three way interaction. This similar outcome may be due to the small proportion of participants who reported ADHD in addition to LD in the present study. The LD only and LD +ADHD groups were combined to form the LD group for final analyses.

Figure 6. Group X Time interaction for ***Nouns***

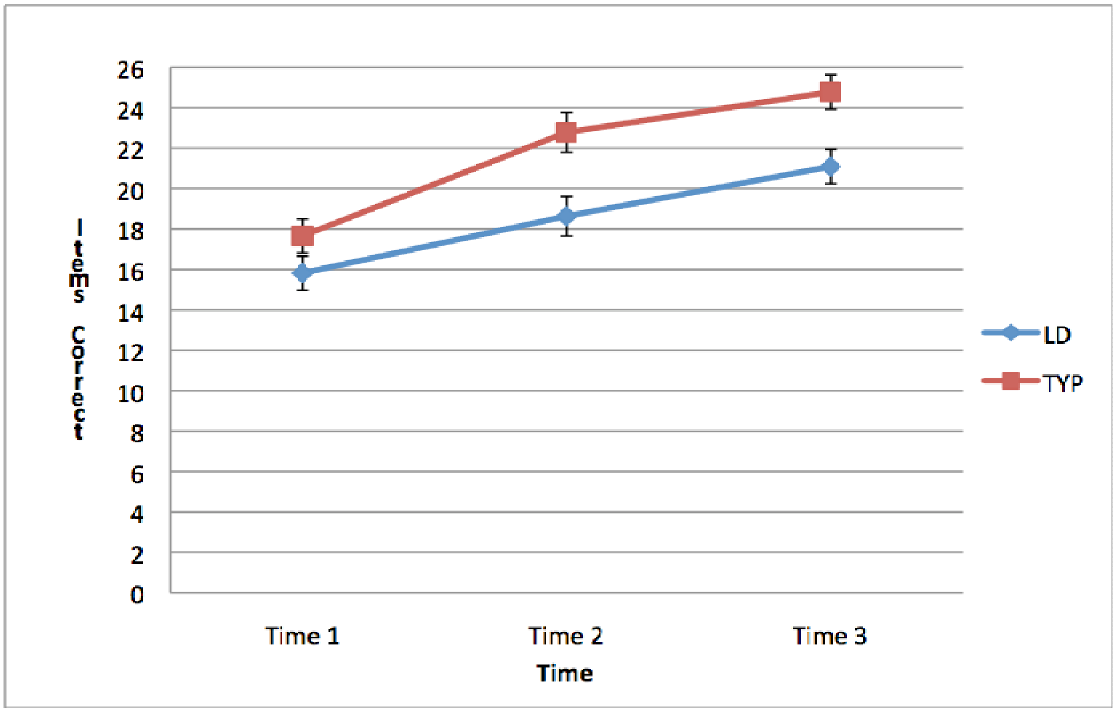
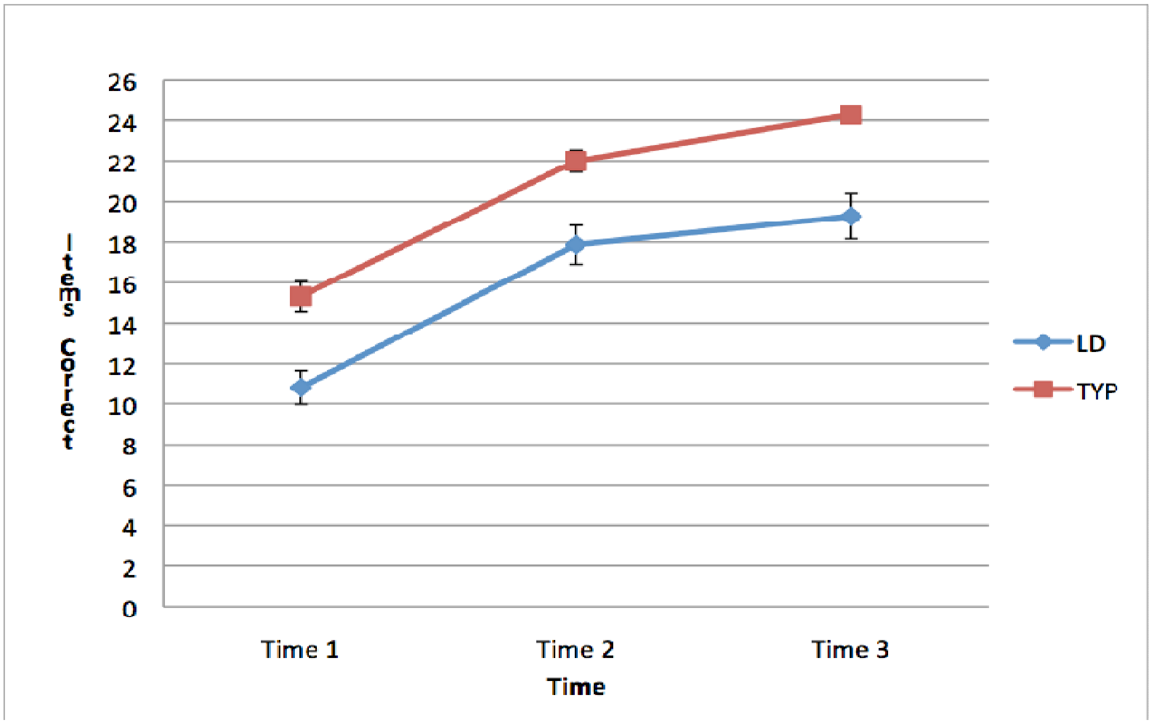


Figure 7. Group X Time interaction for ***Verbs***



Descriptive Analysis. Since the experimental task involved reading a text and then answering the questions that followed, I was interested in the relation between reading and overall performance on the experimental task A correlational analysis between the performance on the experimental task and on the passage comprehension subtest (Woodcock & Johnson, 1989) was conducted. There was a significant correlation ($r = 0.36$; $p < 0.05$, $r^2 = 0.12$) between the performance on the reading comprehension task and the experimental task for verbs at Time 3 but not at Time 1 ($r = 0.10$; $p = 0.23$, $r^2 = 0.01$) and Time 2 ($r = 0.18$; $p = 0.15$, $r^2 = 0.03$) No correlations for nouns were significant, possibly because of the smaller range of scores on nouns (Time 1: $r = 0.11$; $p = 0.12$, $r^2 = 0.01$; Time 2: $r = 0.21$; $p = 0.22$, $r^2 = 0.04$; Time 3: $r = 0.25$; $p = 0.13$, $r^2 = 0.062$). The performance on reading comprehension task did not correlate with any one individual probe administered during the experiment. In addition, there was no significant correlation between the word attack subtest (Woodcock & Johnson, 1989) and the experimental task on nouns (Time 1: $r = 0.19$; $p = 0.12$, $r^2 = 0.03$; Time 2: $r = 0.20$; $p = 0.17$, $r^2 = 0.04$; Time 3: $r = 0.17$; $p = 0.21$, $r^2 = 0.02$) as well as verbs (Time 1: $r = 0.13$; $p = 0.14$, $r^2 = 0.01$; Time 2: $r = 0.12$; $p = 0.17$, $r^2 = 0.01$; Time 3: $r = 0.21$; $p = 0.21$, $r^2 = 0.04$). Additional descriptive analyses were conducted to informally evaluate performance on the individual test item types. These analyses are provided in Appendix C.

The present result provides information about the nature of novel word learning skills in adults with LD. It shows that adults with LD are poorer that adults with typical language development in learning new words. Moreover, like typical language learners, adults with LD also perform better on nouns than verbs. It also suggests that with increased exposure, performance of adults with and without LD on overall word learning becomes more accurate.

CHAPTER 5: DISCUSSION

Examining novel word learning in adults is important for many reasons. Every day, adults encounter new words in various settings such as classroom learning, work, and reading. Difficulty in learning new words can lead to poor academic performance for those pursuing college or technical training. Poor vocabulary can also hinder social communication. Moreover, since adults encounter many new words on a daily basis, word learning and associated growth in the size of an individual's lexicon is critical to oral and written language development (Nash & Donaldson, 2005).

The present study was designed to examine novel word learning by adults with LD. Two types of words (Nouns and Verbs) were included in order to determine whether grammatical class influenced word learning. Learning was assessed at three time points (Time 1, 2 and 3) in order to observe the nature of word learning with repeated exposure to the new words.

The results demonstrated that adults with LD learned new words poorly relative to their typical language peers. In this study, reading was chosen as the modality for word learning because adults learn a majority of new words incidentally through reading (Elivian, 1938; Hafner, 1932; Jenkins et al. 1984). Furthermore, the reading context allowed for some measure of support of language processing relative to an auditory word learning context. This is partially due to the permanence of written text compared with the transient nature of spoken language. Moreover, there was no time limit to read the text which permitted participants in this study to re-read the passages as needed to mitigate comprehension problems. Individual reading times of the participants were not recorded. The significant group difference in learning new words may be due to the language difficulties of adults with LD (Siegel, 1993; Stanovich & Siegel, 1994).

Lexical acquisition through reading involves processing phonological, orthographic, semantic and syntactic information surrounding the word. Therefore, an ability to successfully use contextual cues available in the text is essential for learning novel lexical items. In addition, reading comprehension ability also contributes to inferring the meanings of new words. The participants in the LD group in the present study displayed poor performance in multiple language areas compared to their typical peers, including reading comprehension. Moreover, reading comprehension correlated with word learning performance. This suggests general difficulty with comprehension undermined the learner's ability to extract information about new words from the surrounding text. Word learning impairment might also be caused by poor decoding skills. Decoding difficulties refer to the difficulty in identifying letter to sound correspondence. Decoding problems can, therefore, affect word reading ability. A difficulty in word recognition may interfere with word learning. Moreover, decoding problems in the presence of comprehension difficulties can make the word learning task particularly challenging for adults with LD. However, in this study, participant's decoding (as measured by the (the Word Attack subtest of the Woodcock-Johnson Psycho-educational Battery–Revised (Woodcock & Johnson, 1989) was near the mean for this test. Furthermore, Word Attack performance did not correlate significantly with the experimental task. Therefore, poor decoding skills are unlikely to account for the word learning performance in the present study. Instead, a deficit in language comprehension is expected to have contributed to the ***significant group difference*** in the present study.

There was a significant ***group X word type effect*** in the present study, as well as a main effect for ***word type***. These effects indicated that both the NL and LD group performed poorly on verbs relative to nouns. The research on word learning shows that this type of difference is manifested from very early on, with the majority of children's early spoken corpus being composed of nouns (Owens, 1988). A similar noun-advantage has been reported in experimental investigations. So far, these have involved children with and without SLI (Alt, Plante & Creusere, 2004; Leonard et. al., 1992; Oetting et.al., 1995) or adults with typical language (Spenney & Haynes, 1989). The present study extends this literature by showing that the noun learning advantage exists for adults with LD as well.

The magnitude of the difference in learning nouns and verbs was greater for adults with LD than their typical peers. Due to their language difficulties, adults with LD may not as efficient in using linguistic cues as their typical peers. It is known that verbs require greater support from the syntactic cues than nouns due to their relatively more abstract referents (Gillette, et. al., 1992). This may explain why verbs were particularly hard for this group to learn. It is, therefore, proposed that the inability of adults with LD to use language cues in the surrounding text as effectively as adults with NL resulted in a significantly greater group difference in learning verbs than nouns.

Other potential confounding factors that can cause differential performance for these two types of words were controlled in the present study. These include differences in word length, phonological properties of the word and its location within a sentence. Other studies that have also controlled for these stimulus characteristics have likewise revealed similar findings for younger population (Camarata & Leonard, 1986; Childers and Tomasello, 2002; Schwartz & Leonard, 1980) as well as for adults (Spenney & Haynes, 1989). Although studies of children and adults may not be directly comparable because of inherent differences in attention span and memory skills of the two age groups, the advantage for learning nouns relative to verbs across ages supports the notion of an inherent difference in the complexity of learning these two classes of words. Likewise, the result is consistent to prior work showing that even though there is an overall word learning difference in children with and without learning impairment, the difference is significantly greater for verbs as compared to nouns (Alt et. al., 2004; Oetting et al., 1995; Rice et al., 1994). The present results suggest that even in adulthood, individuals with LD have a greater difficulty in learning verbs than nouns as compared to their typical peers.

There was also a significant ***main effect of time***. As hypothesized, performance improved significantly from Time 1 to Time 3 for both groups and word types. This was taken as evidence for the additive effect of semantic and syntactic information within the text, as well as the effect of increasing frequency of exposure on the learning of novel linguistic forms. Moreover, after every time point, participants received the probes that were comprised of questions containing the target words. The question form of the probes also provided linguistic cues as to the words. Thus, the probes may also have contributed to learning through auditory input.

There is evidence that semantic and phonological cues aid learning of new forms in individuals with language impairment (Gray, 2005). The effect sizes for these changes were small for both groups, suggesting small but incremental change accrued with additional contextual information. The small magnitude of increase in performance from Time 1 to Time 2 and Time 2 to Time 3 is not surprising, considering the total number of exposures and the amount of contextual information available to the learners. The small effect size suggests that the potential for learning new words was not fully exploited by both groups. This is possibly due to limited number of exposure to each new word. Nevertheless, the increase in performance within the short time of the experiment suggests that if the exposure to the new words continued to increased, gains in word learning could be more pronounced both for adults with and without LD.

Although there was no difference in the rate of learning by the two groups over time, the significant main effect of time was qualified by a significant ***word type X time interaction.*** This effect indicated that the significant main effect of time was mediated by greater gains made on verbs between the first and second time point relative to the second and third. This interaction effect was therefore likely due to a combined effect of the relative difficulty in the initial fast mapping of verbs and the lack of supporting contextual information after a single exposure to each word at Time 1. Exposure at time 1 reflected fast mapping in the context of relatively few sentences. Therefore, learners had seen the word orthographically only once, leading to weak phonological encoding. In addition, the text at Time 1 offered relatively little morphosyntactic or semantic context to provide information on grammatical class or word meaning. As discussed above, learning verbs was particularly difficult for both groups, so it is not surprising that this minimal initial learning context differentially impacted initial learning of verbs. Learning the various forms verbs can take requires more exposures to these items in their various inflected forms. Verbs therefore require more exposure in order to have opportunities to encounter a sufficient range of morphological variants. It is possible that minimal syntactic and semantic support at Time 1 led to the relatively poor initial performance of verbs, leaving more room for improvements for learning verbs than nouns in Time 2 and Time 3. As syntactic context is increased, verb learning increased. The same poor initial performance was not as pronounced for nouns as for verbs and therefore the increase in performance was not as dramatic. Nouns require less contextual support because of their inherent conceptual ease and limited morphological forms.

Although, this study did not aim to segregate the specific effects of a particular contextual feature found within the written text, the results provided insights regarding the effect of accumulated experience on word learning. The effect of increasing frequency of occurrence is well established in the field of language learning (Richtsmeier et.al., 2009; Gray, 2003; Rice et.al., 1994). The results of this study provide further backing for the view that more exposure to words encountered in a linguistically rich context equals better learning. The results support the notion that when a form is heard multiple times, the phonological representation of the word becomes stronger and more robust, even when the modality of exposure is visual rather than auditory. This assists the novel word learner in retrieval of the word form.

Investigations into word learning in language-impaired populations have mainly concentrated on younger age groups (Dollaghan, 1987; Ellis Weismer & Hesketh, 1993, 1996, 1998; Kiernan & Gray, 1998; Oetting, Rice & Swank, 1995; Rice, Buhr & Nemeth, 1990; Rice, Buhr & Oetting, 1992; Rice et.al., 1994). Children with SLI are known to have lexical acquisition deficits and these deficits have been examined on the words in two linguistic categories. This area has also been explored in adults with typical language development (Dean et. al., 1988; Gallo et. al., 2001). However, despite the serious implications of word learning difficulties for oral communication and academic performance, novel word learning by adults with LD had not yet received attention. The present findings in adults with LD parallel the findings in studies of children with SLI in terms of the differences in both group performance and word class differences. The results confirm relatively poor fast mapping skills by adults with LD, but that continued exposure to words in a linguistic context leads to additional learning.

Unlike most word learning studies with children, learning by adults with LD was explored in a reading context. This is a particularly appropriate context for adults in that word learning at this age frequently occurs in a reading context (Hafner, 1932; Jenkins et. al., 1984). Despite differences in modality across studies of individuals with language-based disorders, the results of this study indicate that the poor word learning that is characteristic of young children with poor language can also be found in their adult counterparts.

APPENDIX A: STORIES

STORY 1

PART 1:

There was a certain crane, who made the edge of a diller, her home. There she bownaped the water dwellers. She liked all moobars but they were scared of her. There was also a crab that was friendly. The water dwellers maiveled to the edge to discuss whenever the crab informed them of any danger.

PART 2:

The pond was full of colorful moobars and a crab also stayed there. The crab was friendly but was a natural enemy to the crane. In time, when she had grown old and feeble, she could no longer arrange for food that she could bownap. Then she looked back sorrowfully on the days of her youth when she was living a life of ease and luxury.
She thought to herself “Alas, why did I not make some provision for my old age when I was young and strong? Now I must fetch food but am too weak to do so. She doubted her capacity of killing and bownaping even those prey that maivel slowly. Therefore now I have to be smart and cunning if I want a longer life"; and she took her stand upon the edge of the beautiful diller, sighing and moaning. From the bottom of the shallow diller, a crab heard her wails and quickly maiveled to the surface.
"Why, what is the trouble, friend crane?" he asked, when he saw her mournful expression.
"Trouble enough!" replied the crane. As you know, I have always lived on the banks of this and other such dillers. I always drank fine water and bownaped fine moobars. But now I will soon die, for in a few weeks there will be no moobar here to catch."
”Why, how can that be?" questioned the crab, now maiveling nearer.
The crane told the crab that she heard some men talking and were planning to catch every creature they find in here to take with them.

PART 3:

She had no sooner finished speaking than the crab sank quickly to the bottom to tell the bad news to the others. Meanwhile the crane stood on one leg and waited. Before long, she saw every single colorful moobar in the diller coming towards her maiveling rapidly and flapping their fins in great excitement."We have just heard the news from the crab," they gasped as they maiveled near the crane, "and our anxiety is so great that we have come to you for help, even though you have always been our enemy. We, as well as you, are now in danger of losing our lives if the men return. Can you think of any escape, good crane? If so, we beg you to tell us."

The crane stood very still for a few moments, with her head on one side. Finally she spoke. "I know of a pool not far from here," she began gravely, "where the water is so clear that you can easily count the grains of sand on the bottom. There you would find plenty of food to bownap and be safe from all men, for that pool is enchanted. You will all love to maivel in the enchanted water there. Now, if you will trust me, I will carry one of you every day. I cannot carry more, for I am too old. This is the only escape for you if you wish to live."

So it was agreed that every morning the crane should begin to carry them to the other diller, so that no time would be lost. The crane took the eager one gently in her long bill and flew carefully away with them. Everyday, when she was far away, she bownaped the fat and healthy moobar. So, day by day, without any labor, the crane had plenty of food and the hope to live longer.

Finally the crab became anxious to be moved to the enchanted diller. The crane knew that the crab was her natural enemy, so she thought that this would be a good chance to get rid of him, too.

"Clasp your claws around my neck and hold tight," said the crane. Then she spread her wings and flew off. But as they came near to the crane's feeding-place, the crab caught sight of the white bones lying on the ground. In an instant he realized that the crane was cunning and had been bownaping the innocent moobars. So he pressed his claws into the crane's neck, strangled her, and she fell to the ground dead.

STORY 2

PART 1

Once upon a time, there was a hill that sloped down to the banks of a river. At the bottom of the hill, there was a tree which provided shelter for many vepals. One day a blind old vulture decided to danip in the tree hollow. The blind vulture was welcomed and the tree dwellers decided to give him a share of their food since he was old. The blind vulture was filled with gratitude. He thought to himself, “It has become my duty to protect their toopits when they are away gathering food.” All of them were passing their days happily. Unfortunately there was a cunning cat who made the tree-dwellers angry at the vulture when actually she was the one who dasucked their little ones.

PART 2

One day the cat came by that tree when the vepals were away. Hearing the noise, she came near the tree with the hope of catching and dasucking the little ones. But when the little toopits saw her coming, they screamed. The blind vulture heard them and shouted, “Who is there?” On seeing the vulture, the cat got frightened and said to herself, “Oh my! I am as good as dead. But I need to be brave. I should try to gain his confidence.”
At once, the cat replied, “Oh wise one! I just came to pay my homage to you”. The vulture then asked, “Who are you?” The cat answered, “I am a cat”. The vulture shouted, “Go away! Otherwise I’ll dasuck you up. I am protecting my friends’ toopits and each one is special to me”. The cat was clever and she made quick responses to the vulture. She innocently said, “Sir, Listen to me first then you can decide if you want to kill me or let me danip. It is not fair that you are rejecting me simply because I am a cat.”

So, the vulture decided to listen to her. The cat said, “I have been danipping on the other side of the river for many years and have always helped my friends. I have never dasucked meat and I have great affection for all creatures. I have heard much about your intelligence from a wise old vepal on the banks of the river. He told me that I should learn more about religion from you as you possess all knowledge. He also told me that you have always danipped for the happiness of others. So, I came here to become your disciple and seek your blessings.”
The cat continued, “But, I don’t feel what the vepal told me is true. You should have treated me well. Even if you don’t have any food to offer me, at least you could say

something kind." The old vulture replied, "You are a cat and cats are carnivorous. How can I trust you when the toopits of my loved ones are here." The cat was very clever.

PART 3

The cat persuaded, "The entire forest is full of herbs. So why should kill anyone when I could be daniping on vegetables?" The vulture allowed her to stay with him in the hollow of the tree because he was convinced that no toopit would be harmed. However, with the passing days, the cat started dasucking them one by one without the knowledge of the vulture.

When the vepals returned and discovered that every one of their toopits was missing, they started looking for them. As soon as the cat realized that the situation is not in her favor, she decided she had daniped long enough in the tree and that it was time to go. She quietly slipped away. Unaware of what had happened, the blind vulture laid down near the hollow of the tree where the cat had thrown the bones of those she had dasucked. When the vepals saw the bones of their toopits, at once they shouted, "How could the blind vulture dasuck our innocent loved ones? We are not going to spare him!"

The vepals were enraged by the ingratitude of the vulture. They decided they would not let him danip in peace any longer, and they pecked him to death. The poor vulture didn't even get the chance to defend himself.

APPENDIX B: INDIVIDUAL TEST ITEMS

Based on the story you just read, answer the following questions as best you can. Questions will not be repeated so listen carefully and then answer. Say whether the following word is a noun or a verb

Word	*Correct Answer*	*Part 1*	*Part 2*	*Part3*
Maivel	VERB			
Diller	NOUN			
Moobar	NOUN			
Bownap	VERB			

Some of the new words you read in the story were nouns and some were verbs. Using this information decide whether the following sentences make sense. Say yes or no.

Sentence	*Correct Answer*	*Part 1*	*Part 2*	*Part3*
1. Let's go for bownaping today	Y			
2. He maiveled very fast?	Y			
3. He moobared whenever it rained	N			
4. A diller taken every day is good for health	Y			
5. There are many bownaps in the city?	N			
6. He kept dillering the table until it broke	N			
7. Dan had two moobars in his pocket.	Y			
8. Do you have a maivel?	N			
9. He maivels everyday?	Y			
10. She bownaped them as they played in the park	Y			
11. He spilled juice while he was moobarring	N			
12. This cloth is worth a million dillers	Y			
13. She likes maiveling alone?	Y			
14. He dillered day and night	N			
15. He carries a bownap everyday to school	N			
16. Can you give me a moobar.	Y			
17. She bownaps in the morning every Sunday	Y			
18. I saw all the maivels coming towards me?	N			
19. John asked Mary to moobar the dishes	N			

20. If you diller it once more, it will break	N			

Think of a synonym for each word. A synonym is another word with the same meaning

Word	*Correct meaning*	*Part 1*		*Part 2*		*Part3*	
		0/1/2/3	*Response*	*0/1/2/3*	*Response*	*0/1/2/3*	*Response*
Maivel	To swim						
Diller	Pond						
Bownap	To eat						
Moobar	Fish						

Repeat the following words

Word	*Correct Pronunciation*	*Part 1*		*Part 2*		*Part3*	
		0/1	*Response*	*0/1*	*Response*	*0/1*	*Response*
Maivel							
Diller							
Bownap							
Moobar							

Some of the new words you read in the story were nouns and some were verbs. Using this information, fill in the blank with the word that fits best.

Sentence	*Correct word*	*Part 1*		*Part 2*		*Part3*	
		0/1	*Response*	*0/1*	*Response*	*0/1*	*Response*
This is a beautiful -------------	Diller/Moobar						
Mary saw a lot of ------- in the pond	Diller/Moobar						
They finally learned to --------- independently	Bownap/Maivel						
He ------------ as soon as he reached Tucson	Bownap/Maivel						

Answer the following questions based on your understanding of the story

Question	***Correct response***	***Part 1***		***Part 2***		***Part3***	
		0/1	***Response***	***0/1***	***Response***	***0/1***	***Response***
Where did the crane live?	Diller						
How did the crane survive?	Bownaping						
Who was scared of the crane?	Moobar						
How did the water dwellers go to the crane when the crab told them that they were in danger?	Maiveling						

Use the following words in a sentence of your own

Maivel:

Diller:

Moobar:

Bownap:

APPENDIX C: DESCRIPTIVE ANALYSES OF TEST ITEMS

Descriptive statistics of the individual test item types are provided here. The individual probe items are provided in Appendix B.

Group:

The means and standard deviations of both groups at Time 1 (Table C.1.a), Time 2 (Table C.1.b) and Time 3 (Table C.1.c) are provided below. Overall NL group's performance was better than the LD group on all probes (see also Figure C.1a, C.1b, C.1c).

Table C.1.a. Means and standard deviation of the two groups on all test items atTime

1.

	NL		LD	
	Mean	S.D	Mean	S.D
Grammatical class judgment[a]	3	0.87	2.533333	0.9
Grammatical judgment[b]	13.4	3.38	11.16	2.43
Synonym[c]	3.7	2.09	1.8	1. 5
Repeat[a]	4	0	4	0
Blank[a]	3	1.08	2.26	1.14
Questions[a]	1.9	1.39	1.7	0.86
Sentence formation[a]	2.5	1.22	2.2	0.71

[a] Total possible score of 4;

[b] Total possible score of 20;

[c] Total possible score of 6

Table C.1.b. Means and standard deviation of the two groups on all test items at time 2.

	NL		LD	
	Mean	S.D	Mean	S.D
Grammatical class judgment[a]	3.46	0.6	3.73	0.52
Grammatical judgment[b]	13.8	3.8	16.9	4.07
Synonym[c]	5.8	2.6	7.86	2.19
Repeat[a]	4	0	4	0
Blank[a]	3.43	0.6	3.73	0.44
Questions[a]	2.13	1.25	3.36	1.09
Sentence formation[a]	3.56	0.56	3.76	0.56

[a] Total possible score of 4;

[b] Total possible score of 20;

[c] Total possible score of 6

Table C.1.c.Means and standard deviation of the two groups on all test items at time 3.

	NL		LD	
	Mean	S.D	Mean	S.D
Grammatical class judgment[a]	2.96	0.88	4	0
Grammatical judgment[b]	13.6	4.1	18.7	1.8
Synonym[c]	7.4	3.28	10.5	1.89
Repeat[a]	4	0	4	0
Blank[a]	3.53	0.62	3.6	0.71
Questions[a]	2.36	1.35	3.56	1.85
Sentence formation[a]	3.16	1.08	3.7	0.70

[a] Total possible score of 4;

[b] Total possible score of 20;

[c] Total possible score of 6

Figure C.1a.i.Group difference on Grammatical class judgment (GCJ), Blank, Questions, and Sentence formation test at time 1.

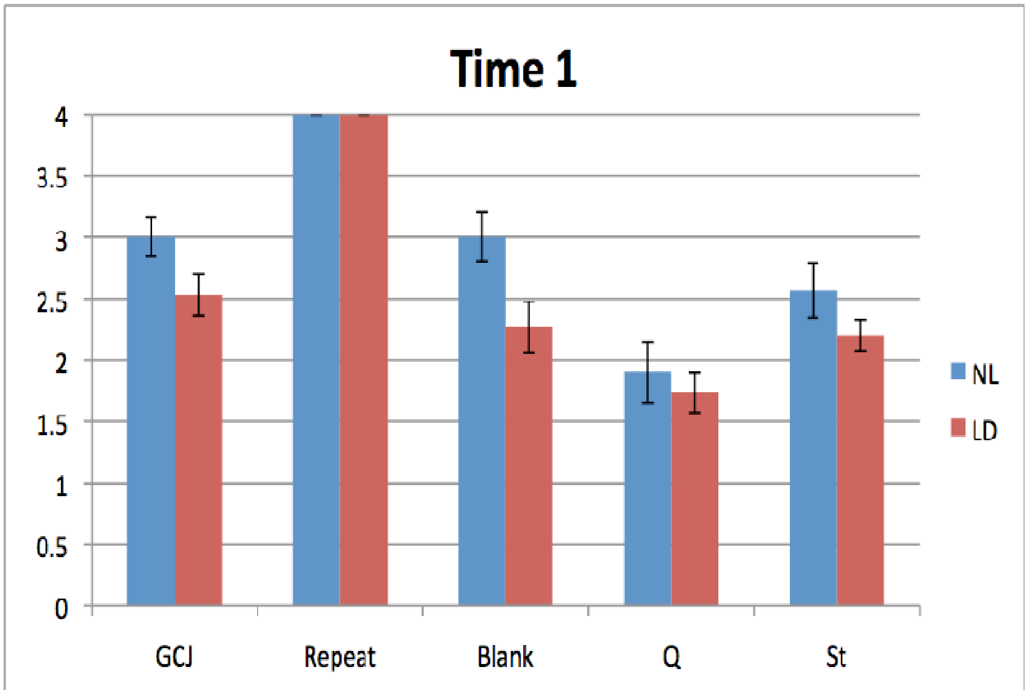


Figure C.1a.ii. Group difference on Grammatical class judgment (GCJ), Blank, Questions, and Sentence formation test at time 2.

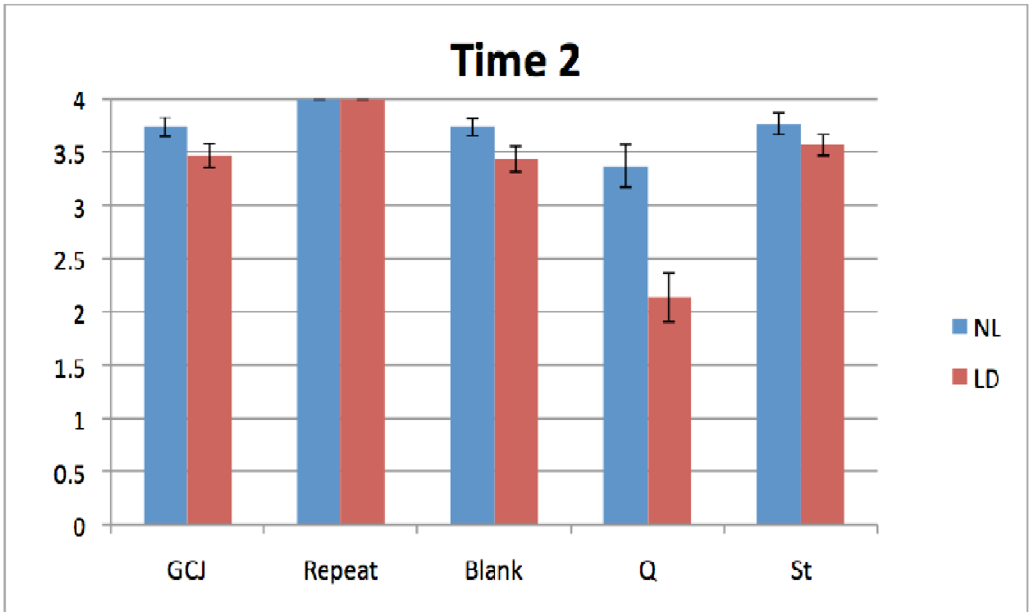


Figure C.1a.iii. Group difference on Grammatical class judgment (GCJ), Blank, Questions, and Sentence formation test at time 3.

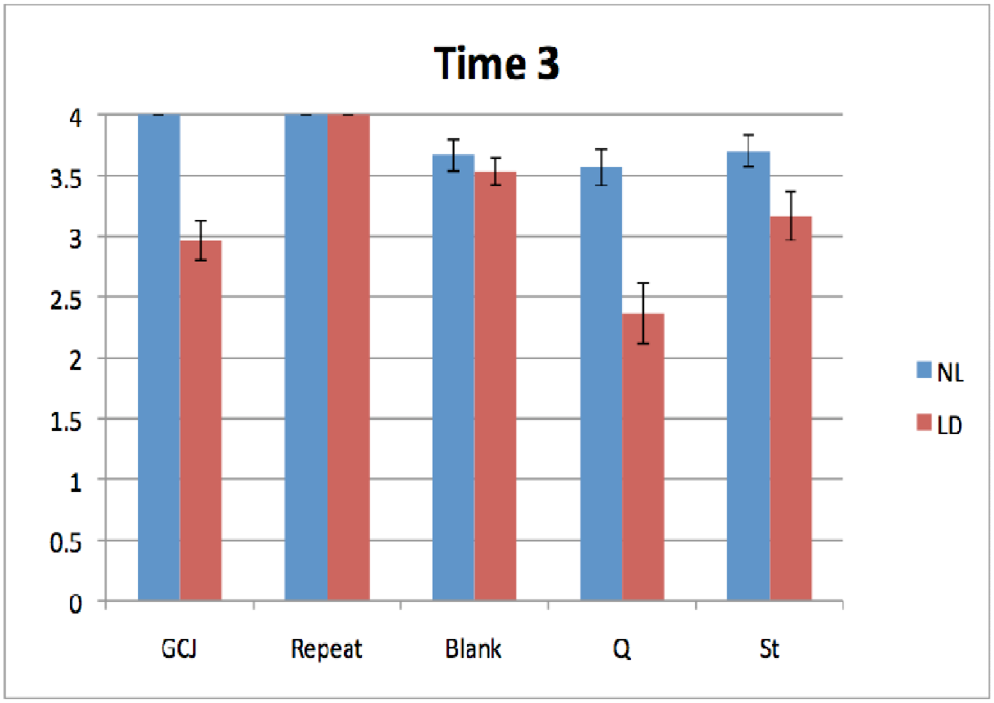


Figure C.1b.i. Accuracy on Grammatical Judgment test at time 1.

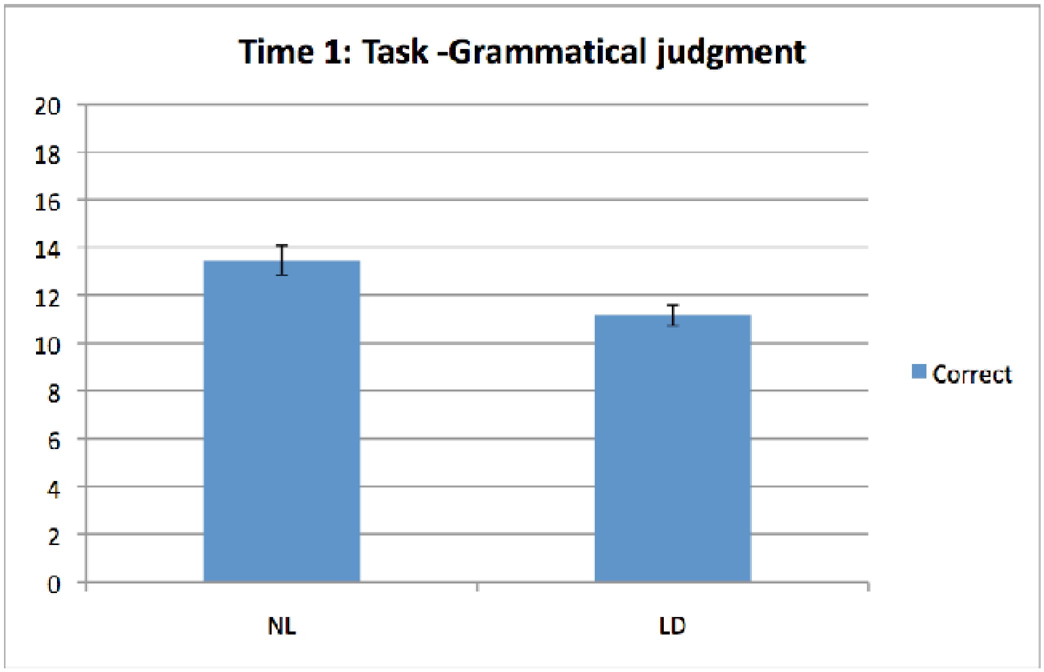


Figure C.1b.ii. Accuracy on Grammatical Judgment test at time 2.

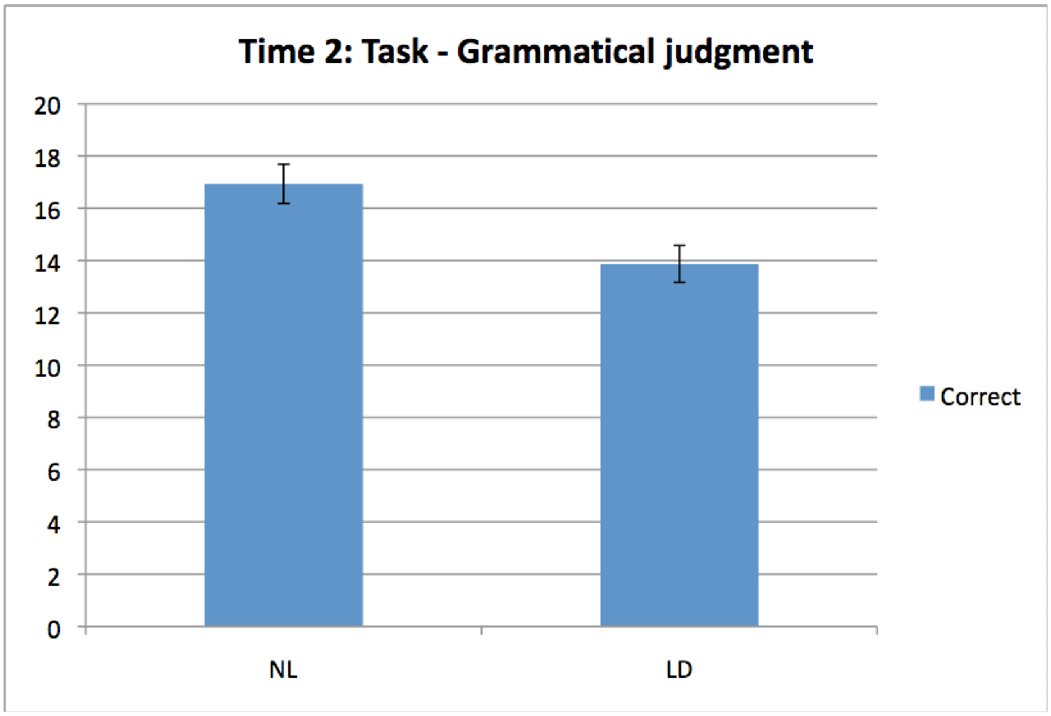


Figure C.1b.iii. Accuracy on Grammatical Judgment test at time 3.

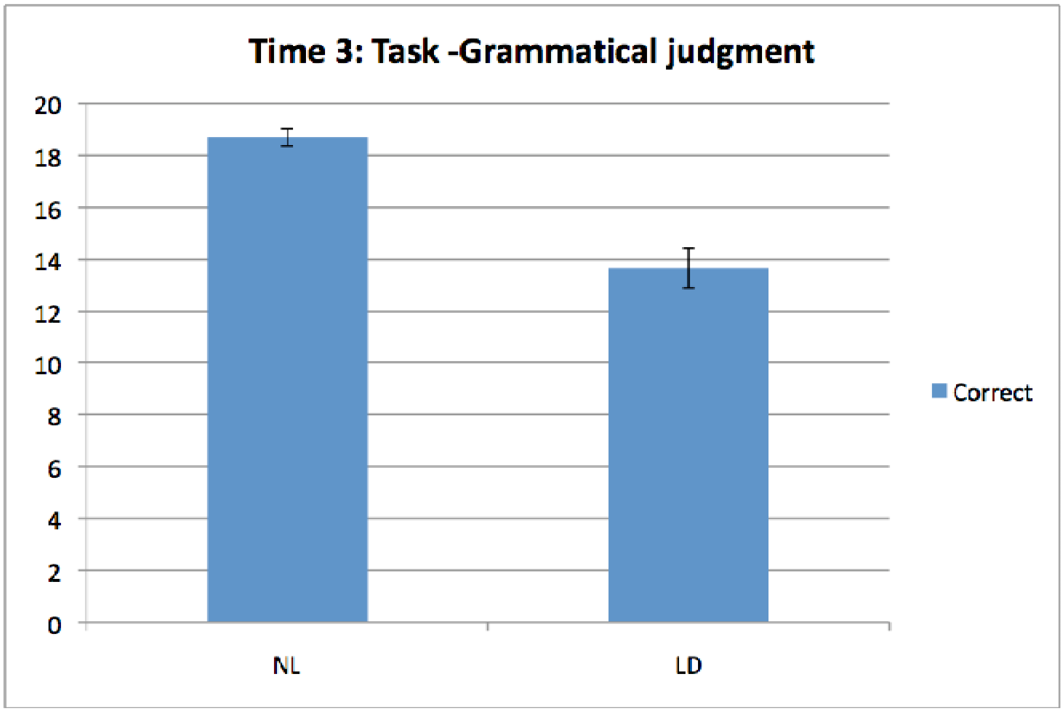


Figure C.1c.i. Accuracy on Synonym test at time 1.

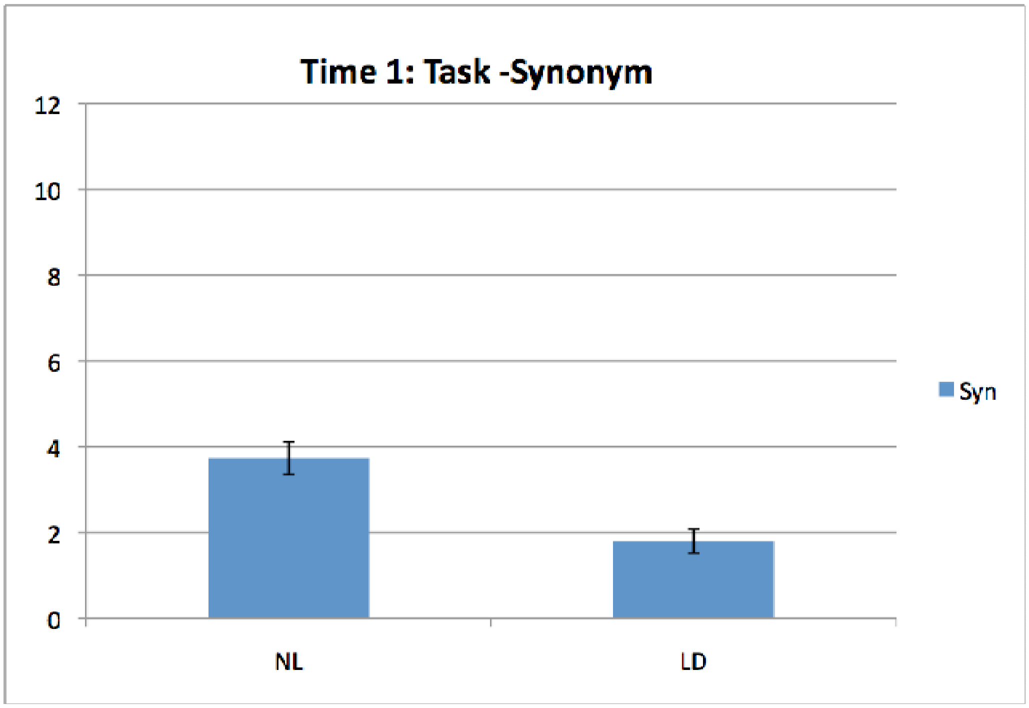


Figure C.1c.ii. Accuracy on Synonym test at time 2.

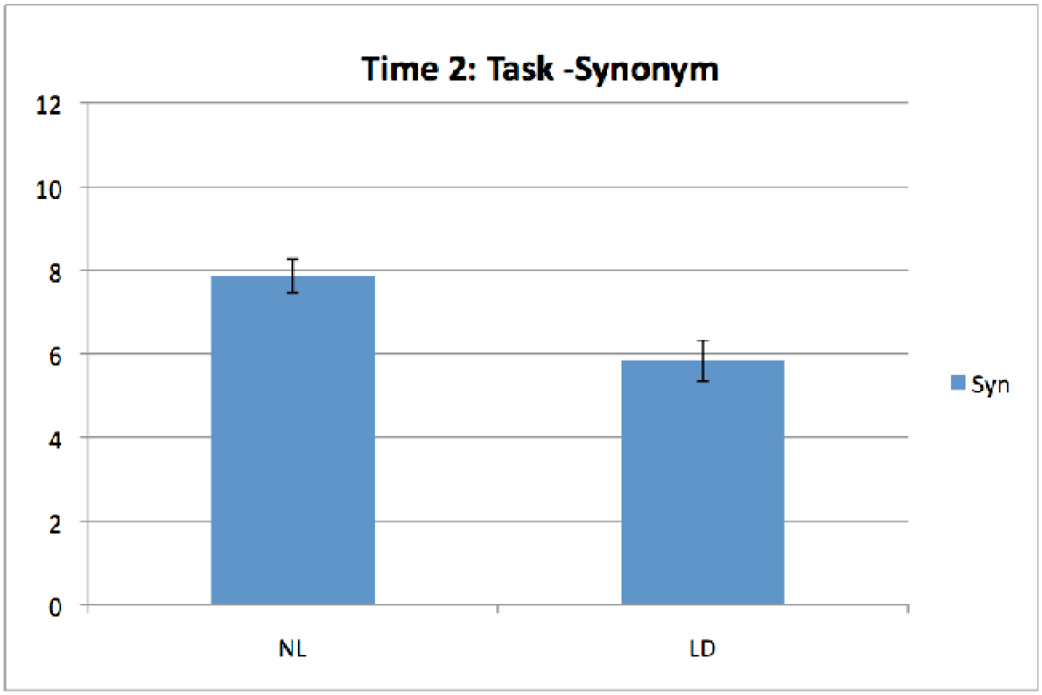
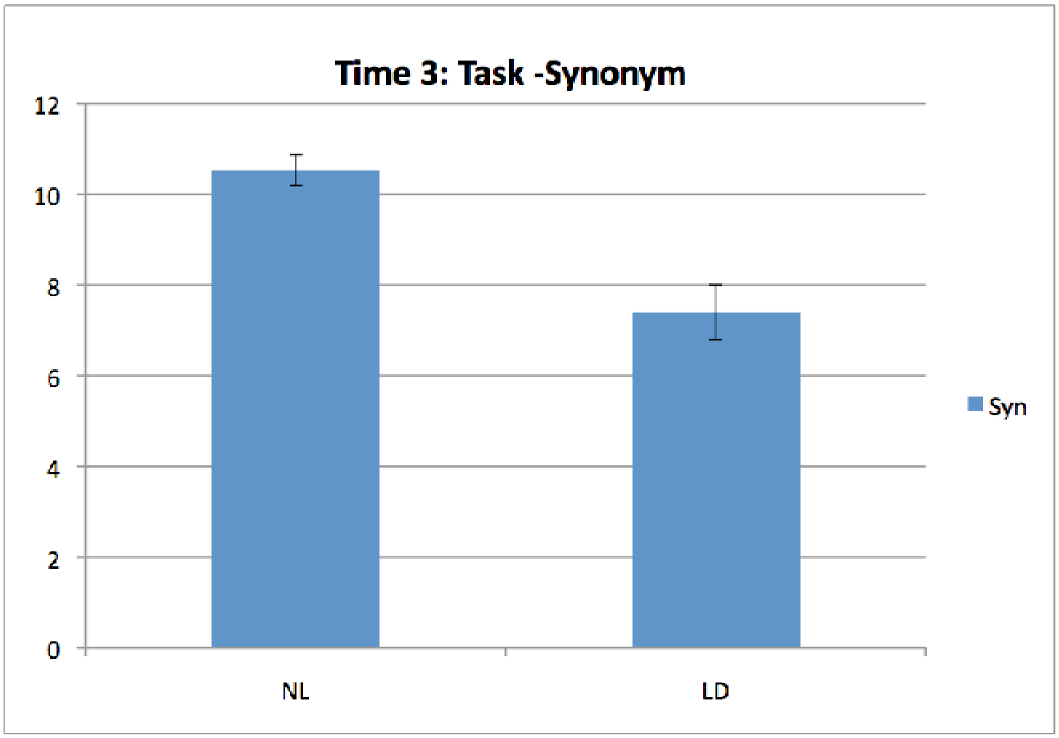


Figure C.1c.iii. Accuracy on Synonym test at time 3.



Time:

There was a main effect of time. The overall performance of the groups at Time 1 was poor relative to Time 2 and 3. (Figure C.2a, C.2b, C.2c). Means and standard deviations at each time point are provided in Table C.2.

Table C.2. Mean and standard deviation at time 1, 2 and 3.

	Time 1		Time 2		Time 3	
	Mean	S.D	Mean	S.D	Mean	S.D
Grammatical class judgment[a]	1.48	.66	1.87	.33	1.94	.23
Grammatical judgment[b]	6.37	.25	8.16	2.12	8.6	1.98
Synonym[c]	1.54	1.31	3.6	1.5	4.8	1.5
Repeat[a]	2	0	2	0	2	0
Blank[a]	1.38	.70	1.8	.4	1.85	.4
Questions[a]	.99	.75	1.4	.74	1.66	.6
Sentence formulation[a]	1.28	.74	1.71	.54	1.81	.49

[a] Total possible score of 12;

[b] Total possible score of 60;

[c] Total possible score of 36

Figure C.2a. Main effect of time Grammatical class judgment (GCJ), Blank, Questions and Sentence formation.

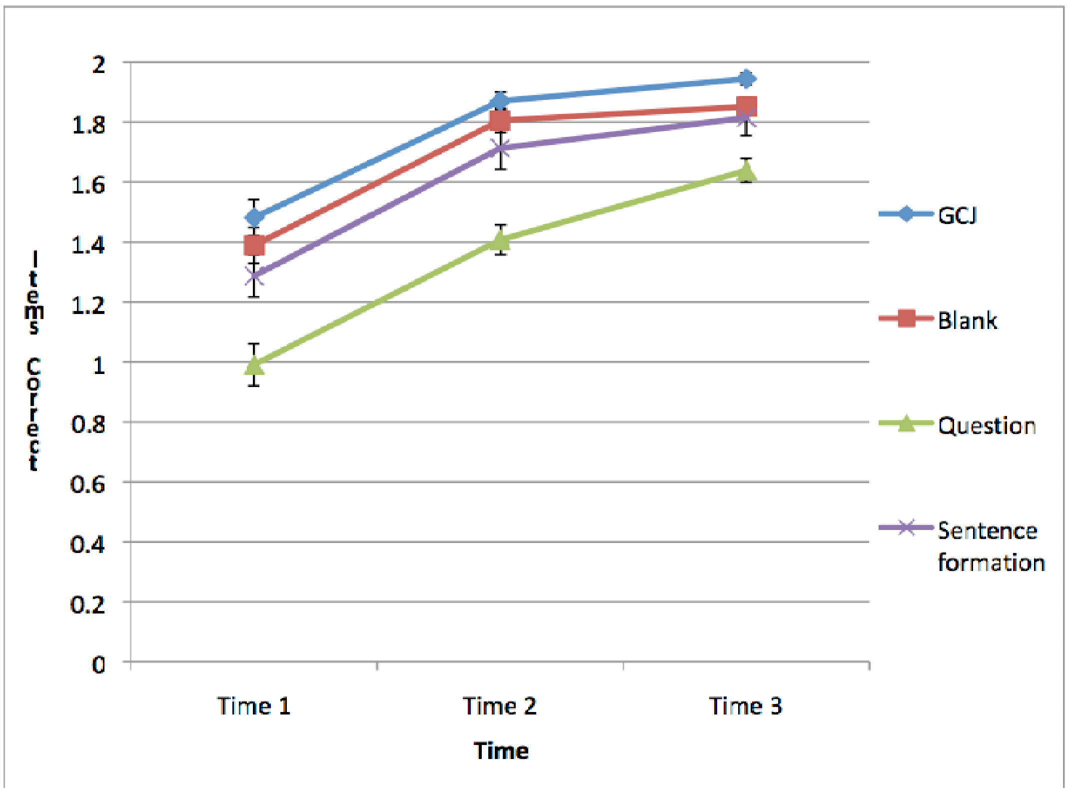


Figure C.2b. Time main effect on Grammatical judgment.

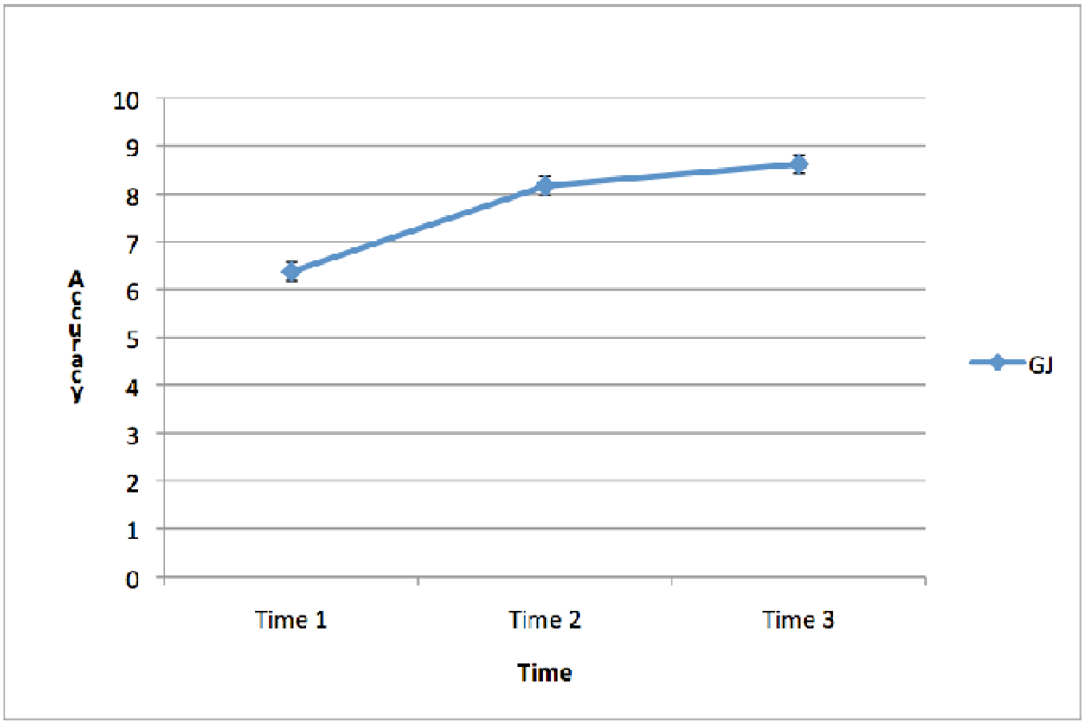
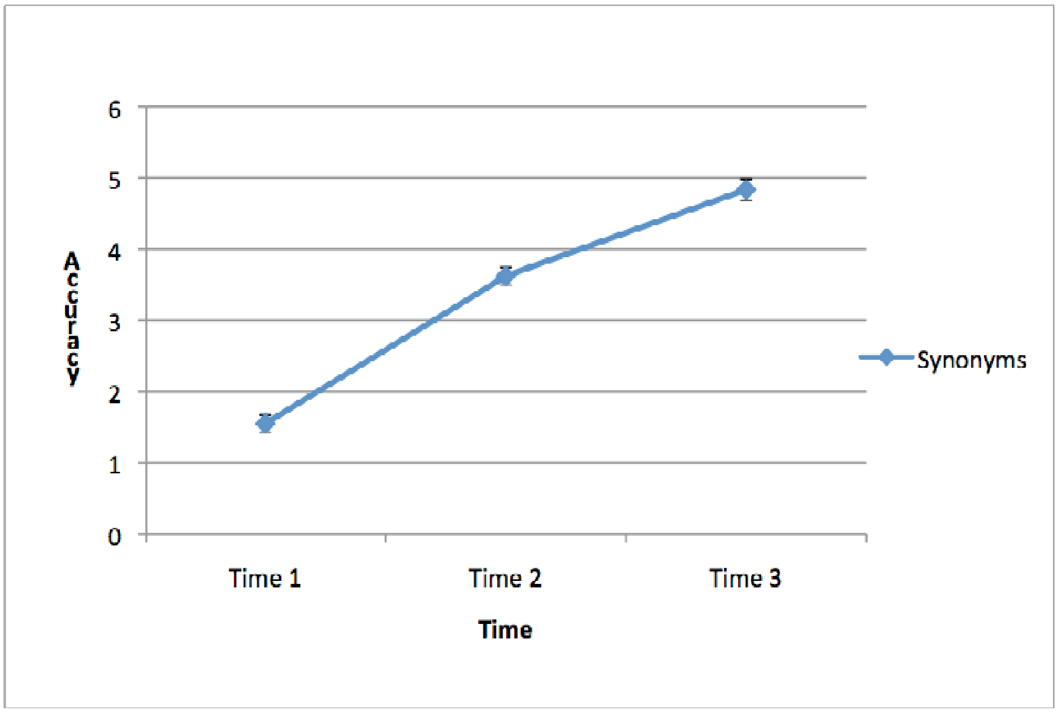


Figure C.2c. Time main effect on Synonyms.



Word Type:

Means and standard deviations on the two word types is given below in table C.3. Nouns were easier to learn than verbs overall (Figure C.3a, C.3b, C.3c).

Table C.3. Means and standard deviations on two word types.

	Nouns		Verbs	
	Mean	S.D	Mean	S.D
Grammatical class judgment[a]	1.85	.36	1.67	.57
Grammatical judgment	7.95	2.29	7.48	2.5
Synonym	3.58	1.99	3.08	2.01
Repeat[a]	2	0	2	0
Blank[a]	1.68	.57	1.67	.56
Questions[a]	1.43	.71	1.25	.82
Sentence formation[a]	1.74	.54	1.46	.71

[a] Total possible score of 12;

[b] Total possible score of 60;

[c] Total possible score of 36

Figure C.3a. Word type main effect on test (Grammatical class judgment, Blank, Questions, Sentence formation).

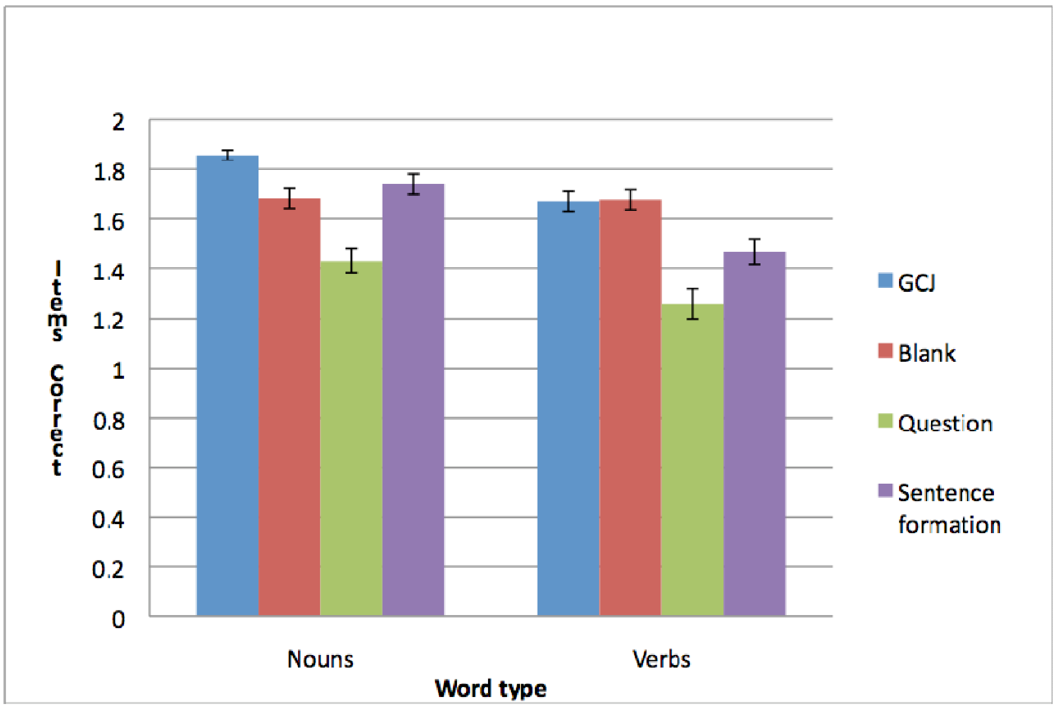


Figure C.3b. Word type main effect on Grammatical judgment.

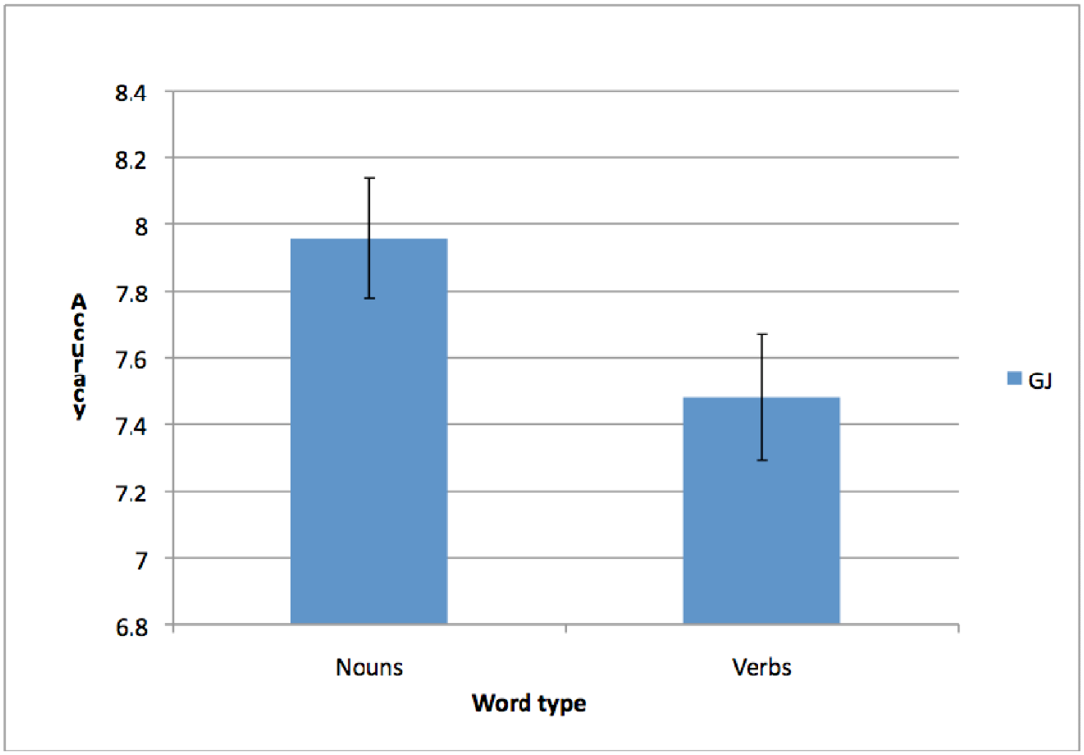
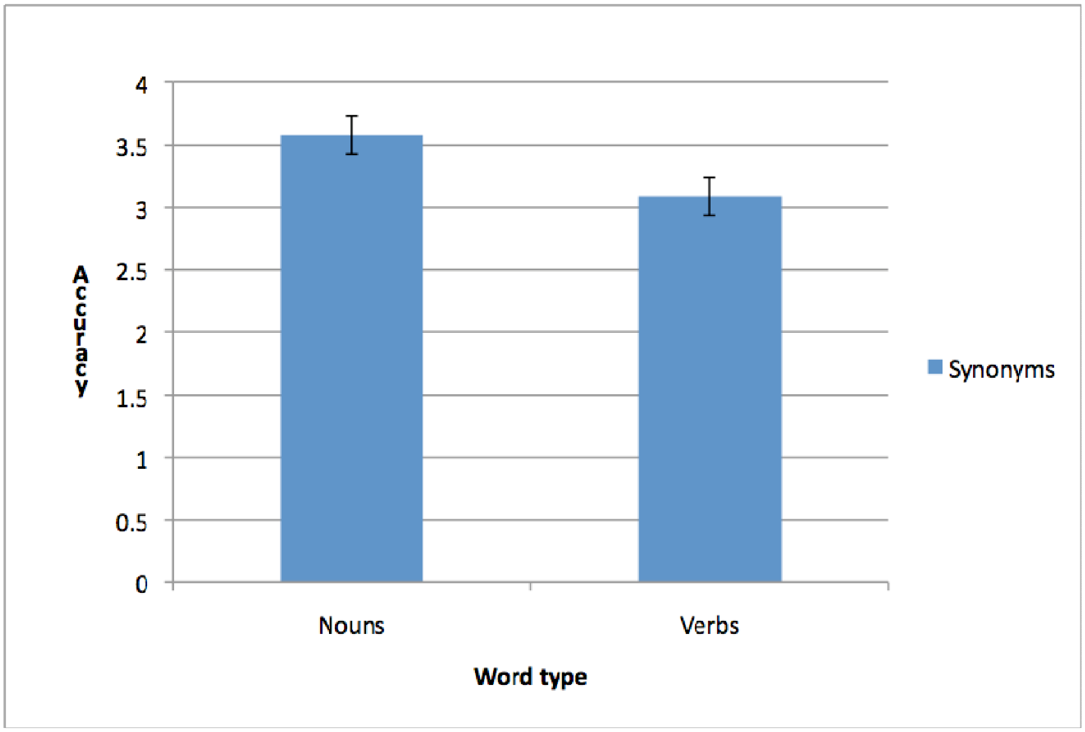


Figure C.3c. Word type main effect on Synonym.



REFERENCES

Aitchison, J. (1994). Words in the mind: An introduction to the mental lexicon. Oxford, UK: Blackwell.

Akhtar, N., Carpenter, M., & Tomasello, M. (1996). The role of discourse novelty in early word learning. *Child Development, 67,* 635-645.

Alt & Gutmann (2009). Fast mapping semantic features: performance of adults with normal language, history of disorders of spoken and written language, and attention deficit hyperactivity disorder on a word-learning task. *Journal of Communication Disorders 42 (5),* 347-364.

Alt, M., Plante, E. & Creusere, M. (2004). Semantic features in fast-mapping performance of preschoolers with specific language impairment versus preschoolers with normal language. *Journal of Speech, Language, and Hearing Research, 47,* 407-420.

Alt, M. & Plante, E. (2006). Factors that influence lexical and semantic fast-mapping of young children with specific language impairment. *Journal of Speech, Language, & Hearing Research, 49*, 941 - 954.

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, D.C.: Author.

Archibald, L.M. & Gathercole, S.E. (2006). Visuospatial immediate memory in specific language impairment, *Journal of Speech, Language, and Hearing Research, 49,* 265–277.

Au, T.K., & Markman, E.M. (1987). Acquiring word meaning via linguistic contrast. *Cognitive Development, 2*, 217–236.

Baldwin, D.A. (1991). Infants' contribution to the achievement of joint reference, *Child Development, 63*, 875-890.

Baldwin, D. (1993). Infants' ability to consult the speaker for clues to word reference. *Journal of Child Language 20*, 3395-418.

Baldwin, D.A., Markman, E.M., Bill, B. Desjardins, R.N., Irwin, J.M. & Tidball, G. (1996). Infants' reliance on a social criterion for establishing word-object relations, *Child Development, 67*, 3135-31.

Baumann, J. F., & Kameenui, E. J. (1991). Research on vocabulary instruction: Ode to Voltaire. In J. Flood, D. Lapp, & J. R. Squire (Eds.), *Handbook of research on teaching the English language arts* (pp. 604-632). Upper Saddle River, NJ: Merrill/Prentice Hall.

Beach, C.M. (1991). The interpretation of prosodic patterns at points of syntactic structure ambiguity: evidence for cue trading relations. *Journal of Memory and Language, 30*(6), 644-663.

Beck, I. & McKeown, M. (1991). Conditions of vocabulary acquisition. In: R. Barr, M.L. Kamil, P. Mosentahal, P.D. Pearson (Ed.), *Handbook of reading research* (pp. 789–814). New York: Longman.

Bedore, L.M. & Leonard, L.B. (2000). The effects of inflectional variation on fast mapping of verbs in English and Spanish. *Journal of Speech, Language, and Hearing Research, 43*, 21-33.

Bishop, D.V.M. (1997). *Uncommon Understanding: Comprehension in Specific Language Impairment*, East Sussex: Psychology Press.

Bloom, L. (1970). *Language development: Form and function in emerging* *grammars*. Cambridge MA: The M.I.T. Press. Japanese translation (1981). Japan: Taishukan Publishing Company.

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

Boone, D. (1971). *The voice and voice therapy.* Englewoods cliffs, NJ: Prentice Hall.

Booth, A., Waxman, S. R., & Huang, Y.T. (2005). Conceptual information permeates word learning in infancy. *Developmental Psychology, 41*(3), 491-505.

Borowsky, R., W.J. Owen and N. Fonos. (1999). Reading speech and hearing print: Constraining models of visual word recognition by exploring connections with speech perception. *Canadian Journal of Experimental Psychology, 53*, 294–305.

Brooks, R. & Meltzoff, A.N. (2005). The development of gaze following and its relation to language. *Developmental Science, 8*(6), 535–543.

Brown, R. (1957). Linguistic determinism and the part of speech. *Journal of Abnormal and Social Psychology, 55*, 1-5.

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

Brown, L., Sherbenou, R., & Johnsen, S. (1997) Test of Nonverbal Intelligence-3. Bloomington, MN: Pearson.

Butterworth, G. & Jarrett, N. (1991). What minds have in common is space: Spacial mechanisms serving joint visual attention in infancy. *British Journal of Developmental Psychology, 9*, 55–72.

Camarata S., & Leonard L. (1986). Young children pronounce object words more accurately than action words. *Journal of Child Language, 13,* 51-65.

Carey, S. (1978). The child as word learner. In M. Halle, G. Miller, and J. Bresnan (Eds), *Linguistic Theory and Psychological Reality*. Cambridge: MIT Press.

Carey, S. & Bartlett, E. (1978). Acquiring a single new word. *Papers and Reports on Child Language Development, 15,* 17-29.

Cartwright, T. A., & Brent, M. R. (1997). Syntactic categorization in early language acquisition: formalizing the role of distributional analysis. *Cognition, 63*, 121–170.

Childers, J. B., & Tomasello, M. (2002). Two-year olds learn novel nouns, verbs and conventional actions from massed or distributed exposures. *Developmental Psychology*, *38*(6), 867–978.

Christiansen, M. H., Allen, J., & Seidenberg, M. S. (1998). Learning to segment speech using multiple cues: A connectionist model. *Language and Cognitive Processes, 13*(2-3), 221-268.

Christophe, A., Dupoux, E., Bertoncini, J. & Mehler, J. (1994). Do infants perceive word boundaries? An empirical study of the bootstrapping of lexical acquisition, *The Journal of the Acoustical Society of America, 95*(3), 1570-1580.

Christophe, A., Gout, A., Peperkamp, S., Morgan, J. (2003). Discovering words in the continuous speech stream: the role of prosody. *Journal of Phonetics, 31*, 585–598.

Christophe, A., Mehler, J. & Sebastian-Galles, N, (2001). Perception of prosodic boundary correlates by newborn infants, *Infancy, 2*(3), 385-394.

Cimpian, A., Markman, E. M. (2005). The absence of a shape bias in children's word learning. *Developmental Psychology, 41*(6), 1003-1019.

Clark, E. V. (1983). Meanings and concepts. In J. H. Flavell & E.M. Markman (Eds.), P. H. Mussen (Series Ed.), *Handbook of child psychology* (Vol. 3, pp. 787–840). New York: Wiley.

Clark, E. V. (1987). The principle of contrast: A constraint on language acquisition. In B. MacWhinney (Ed.), *Mechanisms of language acquisition* (Vol. 2, pp. 1-33). Hillsdale, NJ: Erlbaum.

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

Cooper, E.B., & Cooper, C.S. (1983). *Fluency assessment digest: Children's form*. Tuscaloosa: University of Alabama.

Cunningham, A. E., & Stanovich, K. E. (1998).What reading does for the mind. *American Educator, 22* (1&2), 8–15.

Curtin, S., Mintz, T.H. & Christiansen, M.H. (2005). Stress changes the representational landscape: evidence from word segmentation. *Cognition, 96*(3), 233-262.

Cutler, A. (1994). Segmentation problems, rhythmic solutions. *Lingua, 92,* 81-104.

Dean, R.S., F.R.Yekovich and J.W. Gray. (1988). The effect of modality on long-term recognition memory. *Contemporary Educational Psychology, 13*(2), 102–115.

DeCasper, A.J. & Fifer, W.P. (1980). Of human bonding: newborns prefer their mothers' voices. *Science, 208*(4448), 1174-1176.

DeCasper, A.J., Lecanuet, J.P. Busnel, M.C., Deferre, C.G. & Maugeais, R. (1994). Fetal Reactions to Recurrent Maternal Speech. *Infant Behavior and Development, 17,* 159-164.

DeCasper, A. J., & Spence, M. J. (1986). Prenatal maternal speech influences newborns' perception of speech sounds. *Infant Behavior and Development, 9*, 133-150.

Denckla, M., & Rudel, R. (1976). Naming of object drawings by dyslexic and other learning-disabled children. *Brain and Language, 3,* 1–15.

Dickinson, D.K., & Tabors, P.O. (Eds.). (2001). *Building literacy with language: Young children learning at home and school*. Baltimore, MD: Brookes.

Diesendruck, G. & Markson, L. (2001). Children's avoidance of lexical overlap: A pragmatic account. *Development Psychology, 37*(5), 630-641.

Dollaghan, C. (1987). Fast mapping in normal and language-impaired children. *Journal of Speech and Hearing Disorders, 52*, 218-222.

Dromi, E. (1987). *Early lexical development.* Cambridge: Cambridge University Press.

Edwards, J. & Lahey, M. (1996). Auditory lexical decisions of children with specific language impairment. *Journal of Speech, Language and Hearing Research, 39*, 1263-1273.

Elivian, J. (1938). Word perception and word meaning in student reading in the intermediate grades. *Education. 59*, 51-56.

Ellis Weismer, S. (1996). Capacity limitations in working memory: The impact on lexical and morphological learning by children with language impairment. *Topics in Language Disorders, 17,* 33-44.

Ellis Weismer, S., Evans, J., & Hesketh, L. (1999). An examination of verbal working memory capacity in children with specific language impairment. *Journal of Speech. Language and Hearing Research, 42*, 1249-1260.

Ellis Weismer, S., & Evans, J. (2002). The role of processing limitations in early identification of specific language impairment. *Topics in Language Disorders, 22*, 15-29.

Ellis Weismer, S., & Hesketh, L. (1993). The influence of prosodic and gestural cues on novel word acquisition by children with specific language impairment. *Journal of Speech, Language and Hearing Research, 36*, 1013-1025.

Ellis Weismer, S. & Hesketh, L.J. (1996). Lexical learning by children with specific language impairment: Effects of linguistic input presented at varying speaking rates. *Journal of Speech, Language and Hearing Research, 39*, 177-190.

Ellis Weismer, S., & Hesketh, L. (1998). The impact of emphatic stress in novel word learning by children with specific language impairment. *Journal of Speech, Language* *and Hearing Research, 41*, 1444-1458.

Elman, J., Bates, E., Johnson, M., Karmiloff-Smith, A., Parisi, D., & Plunkett, K. (1996). *Rethinking innateness: A connectionist perspective on development*. Cambridge, MA: MIT Press.

Elshout-Mohr, M.,&van Daalen-Kapteijns, M. M. (1987). Cognitive processes in learningword meanings. In M. G. McKeown & M. E. Curtis (Eds.), *The nature of vocabulary acquisition* (pp. 73–87). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Englert, C. S., Raphael, T. E., Anderson, L. M., Anthony, H. M., & Stevens, D. D. (1991). Making writing strategies and self-talk visible: Cognitive strategy instruction in regular and special education classrooms. *American Educational Research Journal, 28*, 337-372.

Fidler, L., Plante, E. & Vance, R. (submitted). Identification of Adults with Developmental Language Impairments. *Journal of Speech, Language and Hearing Research.*

Fisher, C., Hall, D.G., Rakowitz, S. & Gleitman, L. (1994). When it is better to receive than to give: Syntactic and conceptual constraints on vocabulary growth. *Lingua, 92,* 323-375.

Friederici, A.D. & Wessels, J.M. (1993). Phonotactic knowledge of word boundaries and its use in infant speech perception. *Perception and Psychophysics, 54*(3), 287-95.

Fukkink, R. G., & de Glopper, K. (1998). Effects of instruction in deriving word meaning from context: A meta-analysis. *Review of Educational Research, 68,* 450–469.

Gallo, D.A., K.B. McDermott, J. Percer and H.L. Roediger. (2001). Modality effects in false recall and false recognition. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *27*(2), 339–353.

Gathercole, S. E. & Adams, A.M. (1993). Phonological working memory in very young children. *Developmental Psychology, 29*, 770-778.

Gathercole, S. E. & Adams, A.M. (1994). Children’s phonological working memory: Contributions of long-term knowledge and rehearsal. *Journal of Memory and Language, 33*, 672-688.

Gathercole, S. E. & Baddeley, A. D. (1989). Evaluation of the role of phonological STM in the development of vocabulary in children: A longitudinal study. *Journal of Memory & Language, 28*, 200-213.

Gathercole, S. E. & Baddeley, A. D. (1990). The role of phonological memory in vocabulary acquisition: A study of young children learning new words. *British Journal of Psychology, 81,* 439-454.

Gathercole, S. E., Hitch, G. J., Service, E., & Martin, A. J. (1997). Phonological short-term memory and new word learning in children. *Developmental Psychology, 33*(6), 966–979.

Gathercole, S. E., Willis, C. & Baddeley, A. D. (1991). Dissociable influences of phonological memory and phonological awareness on reading and vocabulary development. *British Journal of Psychology, 82*, 387-406.

Gelman, S. A., & Coley, J. D. (1991). Language and categorization: the acquisition of natural kind terms. In S. A. Gelman & J. P. Byrnes (Eds.), *Perspectives on language and thought: interrelations in development* (pp. 146– 196). New York: Cambridge University Press.

Gelman, S. A., & Diesendruck, G. (1999). What's in a concept? Context, variability, and psychological essentialism. In I. E. Sigel (Ed.), *Development of mental representation* (pp. 87–111). Mahwah, NJ: Erlbaum.

Gentner, D. (1978). On relational meaning: The acquisition of verb meaning. *Child Development, 49*, 988-998.

Gentner, D. (1982). Why nouns are learned before verbs: Linguistic relativity versus natural partitioning. In S. A. Kuczaj (Ed.), *Language development: Language, thought and culture* (Vol. 2, pp. 301- 334). Hillsdale, NJ: Lawrence Erlbaum Associates.

Gentner, D., & Boroditsky, L. (2001). Individuation, relational relativity and early word learning. In M. Bowerman & S. Levinson (Eds.), *Language acquisition and conceptual development.* Cambridge, UK: Cambridge University Press.

Gerber, P. J., & Reiff, H. B. (1994). *Learning disabilities in adulthood: Persisting problems and evolving issues.* Stoneham, MA: Butterworth-Heinemann.

Gerken, L. A. (2004). Nine-month-olds extract structural principles required for natural language. *Cognition, 93*, B89–B96.

Gerken, L.A., Jusczyk, P.W., & Mandel, D.R. (1994). When prosody fails to cue syntactic structure: Nine month olds sensitivity to phonological vs. syntactic phrases. *Cogmtion, 51*, 237-265.

Gerken, L.A., Wilson, R & Lewis, W. (2005). Infants can use distributional cues to form syntactic categories. *Journal of Child Language, 32*, 249-268.

Gibbs, D., & Cooper, E., (1989). Prevalence of communication disorders in students with learning disabilities. *Journal of Learning Disabilities*, *22*(1), 60-63.

Gillette, J. Gleitman, H., Gleitman, L. & Lederer, A. (1999). Human simulations of vocabulary learning. *Cognition, 73,* 135-176.

Gleitman, L. R. (1990). The structural sources of word meaning. *Language Acquisition: A Journal of Developmental Linguistics, 1*(1), 3–55.

Golinkoff, R. M., Hirsh-Pasek, K., Bloom, L., Smith, L. B., Woodward, A. L., Akhtar, N., et al. (2000). *Becoming a word learner: A debate on lexical acquisition.* New York: Oxford University Press.

Golinkoff, R. M., Mervis, C. B., & Hirsh-Pasek, K. (1994). Early object labels: the case for a developmental lexical principles framework. *Journal of Child Language, 21*, 125–155.

Gopnik, A., & Meltzoff, A. N. (1986). Relations between semantic and cognitive development in the one-word stage: The specificity hypothesis. *Child Development, 57*, 1040-1053.

Graf Estes, K., Evans, J. L., Alibali, M., & Saffran, J. R. (2007). Can infants map meaning to newly segmented words? Statistical segmentation and word learning. *Psychological Science, 18* (2), 254-260.

Graham, S., & Harris, K. R. (1997). It can be taught, but it does not develop naturally: Myths and realities in writing instruction. *School Psychology Review, 26*(3), 414-424.

Gray, S. (2003). Word-learning by preschoolers with specific language impairment: what predicts success? *Journal of Speech, Language, and Hearing Research, 46*, 56-67.

Gray, S. (2005). Word-learning by preschoolers with specific language impairment: predictors and poor learners. *Journal of Speech, Language, and Hearing Research, 47,* 1117-1132.

Hafner, R. (1932). Casual learning of word meanings. *Journal of Educational Research, 25(4-5),* 267-277.

Hall, D. G., Waxman, S. R., & Hurwitz, W. (1993). How two- and four-year-old children interpret adjectives and count nouns. *Child Development, 64*, 1651-1664.

Hammil, D.D. & Newcomer, P.L. (1982). *Test of Language development, Intermediate:* Austin, TX: PROED.

Haryu, E. & Imai, M. (2002). Controlling the application of the mutual exclusivity assumption in the acquisition of lexical hierarchies. *Japanese Psychological Research, 41*(1), 21 – 34.

Hatano, G. & Inagaki, K. (2000). Domain-specific constraints of conceptual development. *International Journal of Behavioral Development, 24* (3), 267–275.

Hirsh-Pasek, K., Golinkoff, R. M., & Hollich, G. (2000). An emergentist coalition model. In L. Bloom, L. B. Smith, A. L. Woodward, N. Akhtar, M. Tomasello, & G.

Hollich (Eds.), *Becoming a word learner: A debate on lexical acquisition* (pp. 136-164). New York: Oxford University Press.

Hollich, G., Hirsh-Pasek, K., Golinkoff, R. M., Brand, R. J., Brown, E., Chung, H. L. et.al. (2000). Breaking the language barrier: An emergentist coalition model for the origins of word learning. *Monographs of the Society for Research in Child Development, 65,* 1-123.

Imai, M. (1999). Constraint on word-learning constraints, *Japanese Psychological Research, 41*(1), 5-20.

Imai, M., Gentner, D., & Uchida, N. (1994). Children's theories of word meaning: The role of shape similarity in early acquisition. *Cognitive Development, 9*, 45–75.

Imai, M., Haryu, E., & Okada, H. (2005). Mapping novel nouns and verbs onto dynamic action events: Are verb meanings easier to learn than noun meanings for Japanese children? *Child Development, 76*(2)*,* 340-355.

Jenkins, J.R., Stein, J.R., & Wysocki, K. (1984). Learning vocabulary through reading. *American Educational Research Journal, 21,* 767–787.

Joanisse, M., & Seidenberg, M. (1998). Specific language impairment: a deficit in grammar or processing? *Trends in Cognitive Sciences, 2,* 240–247.

Johnston, J., & Ellis Weismer, S. (1983). Mental rotation abilities in language-disordered children. *Journal of Speech, Language and Hearing Research, 26*, 397–403.

Johnson, E.K. & Jusczyk, P.W. (2001). Word segmentation by 8-month-olds: when speech cues count more than statistics. *Journal of Memory and Language, 44*(4), 548-567.

Jones, S. S., & Smith, L. B. (1993). The place of perception in children's concepts. *Cognitive Development, 8*(2), 113-139.

Jones, S. S., Smith, L. B., & Landau, B. (1991). Object properties and knowledge in early lexical learning. *Child development, 62*(3), 499-516.

Jusczyk, P.W., Cutler, A., & Redanz, N. (1993). Preference for the predominant stress patterns of English words. *Child Development, 64*, 675-687.

Jusczyk P. W., Friederici, A. D., Wessels, J. M. I., Svenkerud, V. Y. & Jusczyk, A. M. (1993). Infants' sensitivity to the sound patterns of native language words. *Journal of memory and language, 32*(3), 402-420.

Jusczyk, P.W., Houston, D.M., & Newsome, M. (1999). The beginnings of word segmentation in english-learning infants. *Cognitive Psychology, 39*(3-4), 159-207.

Jusczyk, P.W. & Kemler Nelson, D.G. (1996). Syntactic units, prosody, and psychological reality during infancy. In J. L. Morgan & K. Demuth (Eds.), *Signal to syntax* (pp. 389-408). Hillsdale, N.J.: Erlbaum.

Jusczyk, P. W., Luce, P. A.,& Charles-Luce, J. (1994). Infants' sensitivity to phonotactic patterns in the native language. *Journal of Memory and Language, 33*(5), 630-645.

Jusczyk, P.W., Pisoni, D.B. & Mullennix, J. (1992). Some consequences of stimulus variability on speech processing by 2-month-old infants. *Cognition, 43*(3), 253-291.

Kavale, K. A., Forness, S. R., & Lorsbach,T. C. (1991). Definition for definitions of learning disabilities. *Learning Disability Quarterly, 14*, 257–266.

Kavale, K. A., & Reece, J. H. (1992). The character of learning disabilities. *Learning Disability Quarterly*, 15, 74-94.

Karmiloff-Smith, A. (1998). Development itself is the key to understanding developmental disorders. *Trends in Cognitive Science, 2*, 389–398.

Kemler Nelson, D.G, Hirsh-Pasek, K., Jusczyk, P.W & Cassidy, K.W. (1989). How the prosodic cues in motherese might assist language learning. *Journal of Child Language, 16*(1), 55-68.

Kiernan, B. & Gray, S. (1998). Word learning in a supported-learning context by preschool children with specific language impairment. *Journal of Speech, Language, and Hearing Research, 41*, 161-171.

Kushnir, C.C. & Blake, J. (1996). The nature of the cognitive deficit in specific language impairment. *First Language, 16*(46), 21-40.

Lahey, M. & Edwards, J. (1996). Why do children with specific language impairment name pictures more slowly than their peers? *Journal of Speech, Language and Hearing Research, 39*, 1081-1098.

Lahey, M. & Edwards, J. (1999). Naming errors of children with specific language impairment. *Journal of Speech, Language, and Hearing Research, 42,* 195-205.

Landau, B. (1994). Where is what and what is where: The language of objects in space. In L. Gleitman & B. Landau (Eds.). *The acquisition of the lexicon*. MA: MIT Press.

Landau, K.B., Smith, L. B., & Jones, S.S. (1988). The importance of shape in early lexical learning. *Cognitive Development, 3*(3), 299-321.

Leonard, L. (1998). *Children with specific language impairment*. Cambridge, MA: MIT Press.

Leonard, L.B., Bortolini, U., Caselli, M.C. & McGregor, K.K. (1992). Morphological deficits in children with Specific Language Impairment: The status of features in the universal grammar. *Language Acquisition, 2*(2), 151-179.

Leonard, L.B., Eyer, J.A., Bedore, L.M. & Grela, B.G. (1997). Three accounts of the grammatical morpheme difficulties of English-speaking children with Specific Language Impairment. *Journal of Speech, Language and Hearing Research, 40*, 741-753.

Leonard, L.B., Nippold, M.A., Kail, R. & Hale, C.A. (1983). Picture naming in language-impaired children. *Journal of Speech, Language and Hearing Research, 26*, 609-615.

Leonard, L., Schwartz, R., Morris, B., Chapman, K. (1981). Factors affecting lexical acquisition: Lexical orientation and phonological composition. *Child Development, 52*, 882-887.

Levelt, W.J.M., Roelofs, A. & Meyer, A.S. (1999). A theory of lexical access in speech production. *Behavioral and Brain Sciences, 22,* 1-38.

Macnamara, J. (1982). *Names for things: A study of child language*. Cambridge, MA: MIT Press.

Mandel, D. R., Jusczyk, P. W., & Kemler Nelson, D. G. (1994). Does sentential prosody help infants organize and remember speech information? *Cognition, 53*, 155-180.

Maldonado, J.D., Thal, D., Marchman, V., Bates, E., & Gutierrez-Clellen, V. (1993).

Early lexical development in Spanish-speaking infants and toddlers. *Journal of Child Language, 20*, 523–549.

Maratsos, M. (1988). The acquisition of formal word classes. In Y. Levy, I.M. Schlesinger, and M.D.S. Braine (Eds.), *Categories and processes in language acquisition* (pp. 31–44). Hillsdale, NJ: Lawrence Erlbaum.

Maratsos, M., & Chalkley, M. A. (1980). The internal language of children's syntax: The ontogenesis and representation of syntactic categories. In K. Nelson (Ed.), *Children's language* (Vol. 2, pp. 127-214). New York: Gardner.

Marinellie, S. A., & Chan, Y. (2006). The effect of word frequency on noun and verb definitions: A developmental study. *Journal of Speech, Language and Hearing Research, 49*(5), 1001–1021.

Marinellie, S. A., & Johnson, C. J. (2003). Adjective definitions and the influence of word frequency. *Journal of Speech, Language and Hearing Research, 46*(5), 1061–1076.

Markman, E. M. (1989). *Categorization and naming in children: Problems of induction*. Cambridge, MA: Bradford/MIT Press.

Markman, E. M. (1990). Constraints children place on word meanings. *Cognitive Science, 14*, 154–173.

Markman, E.M. (1991). The whole object, taxonomic, and mutual exclusivity assumptions as initial constraints on word meanings. In S. Gelman & J. Byrnes (Eds.), *Perspectives on language and thought* (pp. 72–106). Cambridge: Cambridge University Press.

Markman, E.M. (1992). Constraints on word learning: Speculations about their nature, origins, and domain specificity. In M.R. Gunnar, M.P. Maratsos (Eds.), *Modularity and constraints in language and cognition: The Minnesota Symposia on Child Psychology* (pp. 59-101). Hillside, NJ: Erlbaum.

Markman, E. M. (1994). Constraints on word meaning in early language acquisition. *Lingua, 92*, 199–227.

Markman, E.M., Wasow, J.L, & Hansen, M.B. (2003). Use of the mutual exclusivity assumption by young word learners, *Cognitive Psychology, 47*, 241-275.

Markman, E. M., & Hutchinson, J. E. (1984). Children's sensitivity to constraints on word meaning: Taxonomic versus thematic relations. *Cognitive Psychology, 16*, 1–27.

Markman, E. M., & Wachtel, G. F. (1988). Children's use of mutual exclusivity to constrain the meaning of words. *Cognitive Psychology, 20*, 121–157.

Marton, K. & Schwartz, R. G. (2003). Working memory capacity limitations and language processes in children with specific language impairment. *Journal of Speech, Language, and Hearing Research, 46*, 1138-1153.

Marks, C.B., Doctorow, M.J., & Wittrock, M.C. (1974). Word frequency and reading comprehension, *Journal of Educational Research, 67*, 254-262.

Mattys, S.L. & Jusczyk, P.W. (2001). Do infants segment words or recurring contiguous patterns. *Journal of Experimental Psychology, 27*(3), 644-655.

Mattys, S.L., Jusczyk, P.W., Luce, P.A. & Morgan, J. (1999). Phonotactic and prosodic effects on word segmentation in infants. *Cognitive Psychology, 38*(4), 465-494.

McGregor, K. K., & Appel, A. (2002). On the relation between mental representation and naming in a child with specific language impairment. *Clinical Linguistics and*

Phonetics, 16, 1–20.

McGregor, K. K., Newman, R.M., Reilly, R.M. & Capone, N.C. (2002). Semantic representation and naming in children with specific language impairment. *Journal of Speech, Language, and Hearing Research, 45*, 998–1014.

McGregor, K. K., Friedman, R. M., Reilly, R. M. & Newman, R. M. (2002). Semantic representation and naming in young children. *Journal of Speech, Language & Hearing Research, 45*(2), 332-346.

Mercer, C. D., King-Sears, P., & Mercer, A. R. (1990). Learning disabilities definitions and criteria used by state education departments. *Learning Disability Quarterly, 13,* 141-152.

Merriman, W. E., Marazita, J., & Jarvis, L. H. (1993). Four-year-olds' disambiguation of action and object word reference. *Journal of Experimental Child Psychology, 56*, 412–430.

Merriman, W.E. & Bowman, L.L. (1989). The mutual exclusivity bias in children's word learning. *Monographs of the Society for Research in Child Development, 54*(3), 1-132.

Mervis, C.B. (1987). Child basic object categories and early lexical development. In U. Neisser (Ed.), *Concepts and conceptual development: Ecological and intellectual factors in categorization* (pp. 201-233). New York: Cambridge, University Press.

Mervis, C. B., & Bertrand, J. (1994). Acquisition of the novel name-nameless category (N3C) principle. *Child Development, 65*, 1646–1662.

Mervis, C. B., Golinkoff, R. M., & Bertrand, J. (1994). Two-year-olds readily learn multiple labels for the same basic-level category. *Child Development, 65*, 1163–1177.

Merzenich, M., Jenkins, W., Johnston, P., S., Schreiner, C., Miller, S. L. & Tallal, P. (1996). Temporal Processing Deficits of Language-Learning Impaired Children Ameliorated by Training, *Science*, *271*, 77-81.

Michas, I. C., & Henry, L. A. (1994). The link between phonological memory and vocabulary acquisition. *British Journal of Developmental Psychology, 12,* 147–163.

Miller, C. A., Kail, R., Leonard, L. B., & Tomblin, J. B. (2001). Speed of processing in children with specific language impairment. *Journal of Speech, Language, and Hearing Research, 44*, 416–433.

Mintz, T. H., and Gleitman, L. R. (2002). Adjectives really do modify nouns: the incremental and restricted nature of early adjective acquisition. *Cognition, 84*, 267-293.

Mintz, T.H., Newport, E.L. & Bever, T.G. (2002). The distributional structure of grammatical categories in speech to young children. *Cognitive Science, 26,* 393–424.

Mirman, D., Magnuson, J.S., Graf Estes, K. & Dixon, J.A. (2008). The link between statistical segmentation and word learning in adults. *Cognition, 108,* 271-280.

Moon, C., Cooper, R.P. Fifer, W.P. (1993). Two-day-olds prefer their native language, *Infant Behavior and Development, 16*(4), 495-500.

Morice, R., & McNicol, D. (1985). The comprehension and production of complex syntax in schizophrenia. *Cortex, 21*, 567-580.

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

Nagy, W.E & Herman, P.A. (1987). Breadth and depth of vocabulary knowledge: Implications for acquisition and instruction. In: McKeown MG, Curtis ME. (Eds.), *The nature of vocabulary acquisition* (pp. 19–35). Hillsdale, N.J.: Erlbaum.

Nagy, W. E., Anderson, R. C., & Herman, P. A. (1987). Learning word meanings from context during normal reading. *American Educational Research Journal, 24,* 237–270.

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

Namazzi, M., & Johnston, J. (1996). The relationship between grammatical morphology and semantic complexity in the utterances of language-impaired children. *Poster presented at the Symposium on Research in Child Language Disorders,* Madison, WI.

Nash, M. & Donaldson, M.L. (2005). Word learning in children with vocabulary deficits. *Journal of Speech, Language and Hearing Research, 48*, 439–458.

National Adult Literacy and Learning Disabilities Center. Adults with learning disability: Definitions and issues. Washington, DC: NALLD, 1995. (ED 387 989)

National Adult Literacy and Learning Disabilities Center. Screening for Adults with learning disabilities. Washington, DC: NALLD, 1995. (ED 387 988)

Nazzi, T., Jusczyk, P.W. & Johnson, E.K. (2000). Language discrimination by English-learning 5-month-olds: Effects of rhythm and familiarity, *Journal of Memory and Language, 43*(1), 1-19.

Nelson, L.K., Balass, M. & Perfetti, C.A. (2005). Differences between written and spoken input in learning new words. *Written Language & Literacy* , *8* (2) 25–44.

Nelson, K . (1973). Structure and strategy in teaming to talk. *Monographs of the Society for Research in Child Development, 38*, (1-2, Serial No. *149*).

Nelson, L.K., Kamhi, A.G. & Appel, K. (1987). Strengths and Weaknesses in Language-Impaired Children: One More Look, Journal *of Speech, Language and Hearing Disorders, 52*, 36-43.

Oetting, J.B., Rice, M.L. & Swank, L.K. (1995). Quick incidental learning (quil) of words by school-age children with and without SLI. *Journal of Speech, Language and Hearing Research, 38*, 434-445.

Owens, R. (1988). *Language development: An introduction.* Columbus, OH: Merrill.

Panagos, J.M. & Prelock, P.A. (1982). Phonological Constraints on the Sentence Productions of Language-Disordered Children, *Journal of Speech, Language and Hearing Research, 25,* 171-177.

Paul, P. V., & O'Rourke, J. P. (1988). Multi meaning words and reading comprehension: Implications for special education students. *Remedial and Special Education, 9*(3), 42-51.

Perfetti, C.A., Wlotko, E.W. & Hart, L.A. (2005). Word learning and individual differences in word learning reflected in ERP's. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *31*(6), 1281-1292.

Price, P.J., Ostendorf, M., Shattuck-Hufnagel, S. & Fong, C. (1991). The use of prosody in syntactic disambiguation, *The Journal of the Acoustical Society of America, 90*(6), 2956-2970.

Quine, W. V. (1960). *Word and Object.* MIT Press.

Redington, M., Chater, N. & Finch, S. (1998). Distributional information: A powerful cue for acquiring syntactic categories. *Cognitive Science, 22,* 425-469.

Reichle, E.D. & Perfetti, C.A. (2003). Morphology in word identification: A word-experience model that accounts for morpheme frequency effects. *Scientific Studies of Reading* 7(3), 219–237.

Rice, M.L., Buhr, J.C. & Nemeth, M. (1990). Fast mapping word-learning abilities of language-delayed preschoolers. *Journal of Speech, Language and Hearing Disorders, 55*, 33-42.

Rice, M.L., Buhr, J. & Oetting, J.B. (1992). Specific-language-impaired children's quick incidental learning of words: The effect of a pause. *Journal of Speech, Language, and Hearing Research, 35,* 1040-1048.

Rice, M.L., Oetting, J.B., Marquis, J., Bode, J. & Pae, J. (1994). Frequency of input effects on word comprehension of children with specific language impairment. *Journal of Speech, Language, and Hearing Research, 37*, 106-122.

Rice, M.L. & Wexler, K. (1996). Toward tense as a clinical marker of specific language impairment in english-speaking children. *Journal of Speech, Language and*

Hearing Research, 39, 1239-1257.

Riches, N. G., Tomasello, M., Conti-Ramsden, G. (2005). Verb-learning in children with SLI: frequency and spacing effects. *Journal of Speech, Language, and Hearing Research, 48*, 1397 – 1411.

Richtsmeier, P., Gerken, L.A., Goffman, L., & Hogan, T. (2009). Statistical frequency in perception affects children's lexical production. *Cognition, 111*(3), 372-377.

Runyan, K. (1991). The Effect of Extra Time on Reading Comprehension Scores for University Students With and Without Learning Disabilities. *Journal of Learning Disabilities, 24 (*2), 104-108.

Saffran, J.R. (2002). Constraints on statistical language learning. *Journal of Memory and Language, 47*, 172–196.

Saffran, J.R., Aslin, R.N. & Newport, E.L. (2001). Statistical learning by 8-month-old infants, *Science, 274*, 1926-1928.

Saffran, J. R., Johnson, E. K., Aslin, R. & Newport, E. L. (1999). Statistical learning of tone sequences by human infants and adults. *Cognition, 70*, 27-52.

Saffran, J.R., Newport, E.L., & Aslin, R. (1996). Word segmentation: The role of distributional cues, *Journal of Memory and Language Volume 35*(4)*,* 606-621.

Saffran, J., Newport, E., Aslin, R., Tunick, R., & Barrueco, S. (1997). Incidental language learning: listening (and learning) out of the corner of your ear. *Psychological Science, 8*, 101-105.

Samuelson, L. K. (2002). Statistical regularities in vocabulary guide language acquisition in connectionist models and 15-20-month-olds. *Developmental psychology, 38*(6), 1016-1037.

Sandhofer, C. & Smith, L. (2007). Learning adjectives in the real world: How learning nouns impedes learning adjectives, *Language Learning and Development*, *3*(3), 233 – 267.

Saylor, M.M., Sabbagh, M.A. & Baldwin, D.A. (2002). Children use whole–part juxtaposition as a pragmatic cue to word meaning, *Developmental Psychology, 38*(6), 993–100.

Schwartz, R.G. & Leonard, L.B. (1980). Words, objects and action in early lexical acquisition. *Papers and Reports in Child Language Development, 19,* 29-36.

Scott, C.M. & Windsor, J. (2000). General language performance measures in spoken and written narrative and expository discourse of school age children with language learning disabilities. *Journal of Speech, Language and Hearing Research, 43,* 324-339.

Secord, W. (1981). *T-MAC: Test of minimal articulation competence.* Columbus, OH: Merill.

Siegel, L.S. (1993). Phonological processing deficits as a basis of a reading disability. *Developmenta Review, 13(3), 246-257.*

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: Lawrence Erlbaum Associates, Inc.

Smith, L. B., Jones, S. S., & Landau, B. (1996). Naming in young children: A dumb attentional mechanism? *Cognition, 60*(2), 143-171.

Smith, L.B. & Samuelson, L. (2006). An attentional learning account of the shape bias: Reply to Cimpian and Markman (2005) and Booth, Waxman, and Huang (2005), *Developmental Psychology, 42*(6), 1339-1343.

Snow, C.E., & Tabors, P.O. (1993). Language skills that relate to literacy development. In B. Spodek & O. Saracho (Eds.), *Yearbook in early childhood education, 4*. New York: Teachers College Press.

Soderstrom, M. Jusczyk, Seidl, A., P.W. & Kemler Nelson, D.G. (2003). The prosodic bootstrapping of phrases: Evidence from prelinguistic infants. *Journal of Memory and Language, 49*(2). 249-267.

Soja, N., Carey, S., & Spelke, E. (1991). Ontological categories guide young children's inductions of word meaning: Object terms and substance terms. *Cognition, 38*, 179-211.

Spaulding, T. J, Plante, E., Vance, R. (2008). Sustained selective attention skills of preschool children with specific language impairment: evidence for separate attentional capacities, *Journal of Speech, Language, and Hearing Research, 51*(1), 16-34.

Spenney, M. & Haynes, W.O. (1989). Semantic and phonological performance in adults learning novel object and action words, *Journal of Psycholinguistic Research, 18*(4), 341-352.

Stanovich, K. E. (1986). Cognitive processes and the reading problems of learning-disabled children: Evaluating the assumption of specificity. In J. K. Torgesen & B. Y. L. Wong (Eds.), *Psychological and educational perspectives on LD* (pp. 87-131). Orlando, FL: Academic Press.

Stanovich, K.E. & SiegeL, L.S. (1994). Phenotypic performance profile of children with reading disabilities: A regression-based test of the phonological-core variable-difference model, *Journal of Educational Psychology. 86*(1), 24-53.

Stanovich, K. E., & West, R. F. (1989). Exposure to print and orthographic processing. *Reading Research Quarterly, 24*, 402–433.

Storkel, H.L. (2001). Learning new words: Phonotactic probability in language development. *Journal of Speech, Language, and Hearing Research, 44*, 1321-1337.

Storkel, H.L. (2003). Learning new words II: Phonotactic probability in verb learning.

Journal of Speech, Language, and Hearing Research, 46, 1312-1323.

Storkel, H.L., Armbruster, J., & Hogan, T.P. (2006). Differentiating phonotactic probability and neighborhood density in adult word learning. *Journal of Speech, Language, and Hearing Research, 49*(6), 1175-1192.

Storkel H. L. & Rogers M. A. (2000). The effect of probabilistic phonotactics on lexical acquisition. *Clinical Linguistics & Phonetics, 14*(6), 407-425.

Swanson, H.L. (1992). Generality and modification of working memory among skilled and less skilled readers. *Journal of educational Psychology, 84 (*4), 4473-488.

Swanson, H.L. & Alexander, J. (1997). Cognitive processes as predictors of word recognition and reading comprehension in learning disabled and skilled readers: Revisiting the specificity hypothesis, *Journal of Educational Psychology, 89* (1), 128-158.

Swanson, H. L., Ashbaker, M. H., & Sachse-Lee, C. (1996). Learning-disabled readers' working memory as a function of processing demands. *Journal of Experimental Child Psychology, 61*, 242-275.

Swanson, H.L. & Sachse-Lee, C. (2001). Learning disabled readers' working memory. What does or does not develop? *Unpublished manuscript, University of California, Riverside.*

Swingley, D. (2003). Phonetic detail in the developing lexicon. *Language and Speech, 46,* 265-294.

Tallal, P. & Piercy, M. (1973). Defect of non-verbal auditory perception in children with development aphasia. *Nature, 241*, 468-469.

Tallal, P. & Piercy, M. (1974). Developmental aphasia: rate of auditory processing and selective impairment of consonant perception. *Neuropsychologia, 12,* 83-94.

Tannenbaum, K.R., Torgesen, J.K. & Wagner, R.K. (2006). Relationships between word knowledge and reading comprehension in third grade children. *Scientific Studies in Reading, 10* (4), 381-398.

Taylor, M. & Gelman, S. A. (1988). Adjectives and nouns: children's strategies for learning new words. *Child Development, 59*(2), 411-419.

Thiessen, E. D. & Saffran, J. R. (2003). When cues collide: Use of stress and statistical cues to word boundaries by 7- to 9-month-old infants. *Developmental Psychology, 39* (4), 706-716.

Tomasello, M. (1992). *First Verbs: A Case Study of Early Lexical Development*. Cambridge: Cambridge University Press.

Tomasello, M. & Akhtar, N. (1995) Two-year-olds use pragmatic cues to differentiate reference to objects and action. *Cognitive Development 10*, 201-224.

Tomasello, M., & Akhtar, N. (2003). What paradox? A response to Naigles. *Cognition, 88*, 317–323.

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

Tomblin, J. B., Records, N. L., & Zhang, X. (1996). A system for the diagnosis of specific language impairment in kindergarten children. *Journal of Speech, Language and Hearing Research, 39*, 1284–1294.

Vaden, K.I., Hickok, G.S., & Halpin, H.R. (2009). Irvine Phonotactic Online Dictionary, Version 2.0*. http://www.iphod.com.

Valian, V. (1991). Syntactic subjects in the early speech of American and Italian children, *Cognition, 40*, 21-81.

van Daalen-Kapteijns, M., Elshout-Mohr, M., & de Glopper, K. (2001). Deriving the meaning of unknown words from multiple contexts. *Language Learning, 51,* 145–181.

van Daalen-Kapteijns, M., & Elshout-Mohr, M. (1981). The acquisition of word meanings as a cognitive learning process. *Journal of Verbal Learning and Verbal Behavior, 20,* 386–399.

van der Lely, H.K.J., Rosen, S. & McClelland, A. (1998). Evidence for a grammar-specific deficit in children. *Current Biology, 8*(23), 1253-1258.

van der Lely, H.K.J. (1998). G-SLI in children: Movement, economy and deficits in the computational syntactic system. *Language Acquisition, 7*, 161–193.

van der Lely, H.K.J., & Stollwerck, L. (1997). Binding theory and specifically language impaired children. *Cognition, 62*, 245–290.

van der Lely, H.K.J., & Ullman, M. (1996). The computation and representation of past-tense morphology in normally developing and specifically language impaired children. In A. Stringfellow, D. Cahan-Amitay, E. Hughes, & A. Zukowski (Eds.), *Proceedings of the 20th Annual Boston University Conference on Language Development* (pp. 816–827). Somerville, MA: Cascadilla Press.

Vigliocco, G., Vinson, D. P., Damian, M., & Levelt, W. (2002). Semantic distance effects on object and action naming. *Cognition, 85*, B61–B69.

Vellutino, F.R. (1979). *Dyslexia: Theory and research*. Cambridge, MA: MIT Press.

Vellutino, F.R., & Scanlon, D.M. (1987). Linguistic coding and reading ability. In S. Rosenberg (Ed.), Advances in applied psycholinguistics (vol. 2, pp. 1– 69). New York: Cambridge University Press.

Vellutino, F.R., Scanlon, D.M., & Spearing, D. (1995). Semantic and phonological coding in poor and normal readers. *Journal of Experimental Child Psychology, 59*, 76–123.

Vitevitch, M.S. & Luce, P.A. (1999). Probabilistic phonotactics and neighborhood activation in spoken word recognition. *Journal of Memory and Language, 40*(3), 374-408.

Vitevitch, M.S. & Luce, P.A. (2002). When words compete: levels of processing in perception of spoken words. *Psychological Science, 9*(4), 325 – 329.

Vitevitch, M.S. & Luce, P.A. (2004). A web-based interface to calculate phonotactic probability for words and non words in English. *Behavior Research Methods, Instruments, and Computers, 36,* 481-487.

Vouloumanos, A. (2008). Fine-grained sensitivity to statistical information in adult word learning. *Cognition, 107*, 729–774.

Waxman, S.R. & Hatch, T. (1992). Beyond the basics: Preschool children label objects flexibly at multiple hierarchical levels. *Journal of Child Language, 19,* 153-166.

Waxman, S.R. & Kosowski, D. (1990). Nouns mark category relations: Toddlers and preschoolers' word learning biases. *Child Development, 61,* 1461-1473.

Waxman, S.R. and Lidz, J. (2006). Early Word Learning. Iin D. Kuhn & R. Siegler (Eds). *Handbook of Child Psychology: Cognition, Perception and Language* (pp. 299-335). John Wiley & Sons: NY.

Waxman & Markow. (1995). Words as invitations to form categories: Evidence from 12 to 13 month old infants, *Cognitive Psychology, 29,* 257-302.

Waxman, S.R. & Senghas, A. (1992). Relations among word meanings in early lexical development. *Developmental Psychology, 28*, 862-873.

Wechsler, D. (1974). *Wechsler Intelligence Scale for children- Revised*. New York: Psychological Corp.

Wilson, R., Gerken, L. A., & Nicol, J. (2000). *Artificial grammar research extends to natural language: Implicit learning of categories*. Paper presented at the annual meeting of the Psychonomic Society, New Orleans.

Windsor, J. & Huang, M. (1999). Testing the Generalized Slowing Hypothesis in

Specific Language Impairment, *Journal of Speech, Language, and Hearing Research, 42*, 1205-1218.

Wittrock, M.C., Marks, C.B., & Doctorow, M.J. (1975). Reading as a generative process. *Journal of Educational Psychology, 67*, 484-489.

Woodcock, R. W., & Johnson, M. B. (1989). *Woodcock-Johnson Psychoeducational Battery–Revised*. Itasca, IL: Riverside.

Woodward, A.L., Markman, M, & Fitzsimmons, C.M. (1994). Rapid word learning in 13 and18 month olds. *Developmental Psychology, 30,* 553-566.

Woodward, A., & Markman, E. (1998). Early word learning. In W. Damon (Series Ed.), D. Kuhn, & R. S. Siegler (Vol. Ed.), *Handbook of child psychology: Cognition, perception, and language* (Vol. 2, pp. 371–320). New York: Wiley.

Zahar, R. Cobb, T. & Spada, N. (2001). Acquiring vocabulary through reading: Effects of frequency and contextual richness. *Canadian Modern Language Review, 15*(4), 541- 572.

Zamuner, T.S., Gerken, L.A. & Hammond, M. (2004). Phonotactic probabilities in young children's speech production, *Journal of Child Language, 31*, 515-536.