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**Noun and verb reading and retrieval in normal and impaired
readers**

Ferrara, Karen E., Ph.D.
City University of New York, 1992

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**NOUN AND VERB READING AND RETRIEVAL
IN NORMAL AND IMPAIRED READERS**

by

KAREN E. FERRARA

A dissertation submitted to the Graduate Faculty in Psychology in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York.

1992

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This manuscript has been read and accepted for the Graduate Faculty in Psychology in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

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Abstract

NOUN AND VERB READING AND RETRIEVAL
IN NORMAL AND IMPAIRED READERS

by

Karen E. Ferrara

Adviser: Wilma G. Rosen, Ph.D.

Impetus for this study of the influence of lexical class on word retrieval, receptive vocabulary, and reading proficiency was provided by convergent findings from developmental psychology, psycholinguistics, and neuropsychology. Specifically, nouns and verbs: a) are acquired at different points in language development, b) are organized differently in semantic memory, c) contribute differently to comprehension of and memory for language, and d) are differentially impaired in some acquired language deficits. Given the absence of comparable noun and verb retrieval measures for children, the first goal was to devise sets of suitable stimuli. This entailed individual administration of published and original language measures to 23 normal 8- to 12-year-olds. Comparable noun and verb stimuli were selected on the basis of item discrimination index (Flanagan's r) and correlation with other language measures. The second experiment entailed using those stimuli and published vocabulary and reading tests to assess reading, word

knowledge, and retrieval in 20 normal and 20 impaired readers, aged 9 to 11 years. Performances of the two groups on noun and verb measures were compared via split-plot design with repeated measurements ANOVA. Predictive relationships among retrieval, vocabulary and reading measures were determined by multiple regression analysis.

No significant noun-verb differences were found for either group on any expressive or receptive language measure. However, between-group and noun-verb differences were evident in the interrelationships among the variables. For normal readers, word retrieval was better predicted by receptive noun than verb knowledge. For impaired readers, in contrast, verb knowledge was the more significant predictor of retrieval. Moreover, reading proficiency was predicted by different sets of variables for the two groups. For normal readers, reading comprehension and accuracy were best predicted by object and action naming performances in combination. For impaired readers, reading proficiency was best predicted by single-variable models in which verb knowledge was as significant a predictor as object naming. Two important points were suggested: a) noun and verb knowledge and retrieval are non-redundant measures, and b) impaired readers are not simply less proficient normal readers, but differ from normals in qualitative ways.

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INTRODUCTION

From two to eight percent of American children are estimated to have developmental reading disabilities characterized by reading ability significantly below expectations based on levels of general cognitive functioning and academic opportunity (American Psychiatric Association, 1987). Given the academic and social emphasis on transmitting information via written text, uncompensated developmental reading impairments almost guarantee that a child's age-appropriate acquisition of a wide range of information and skills will be compromised. Consequently, factors affecting children's reading skills have constituted a primary research focus.

The process of extracting meaning from printed text depends on the interaction and integration of attentional, perceptual, language, memory, and reasoning skills. Reading accuracy and comprehension may be affected by limitations or developmental delays in any of the perceptual or cognitive skills involved in the reading process. Nevertheless, in contrast with the once predominant view that dyslexia is a function of deficits in visual-perceptual-motor integration, the relationship between developmental language deficits and reading disabilities has emerged as the most consistent finding in

the research (e.g., Felton, Wood, Brown, Campbell, & Harter, 1987; Liberman, 1985; Murphy, Pollatsek, & Well, 1988; Vellutino, 1987; Wolf, 1984). The strength and consistency of this relationship have led some researchers to suggest that language-based deficits are present in virtually all reading disabilities (Liberman, 1985; Vellutino, 1987).

The most salient language deficits among reading impaired children appear to be those related to ability to understand words themselves, and to effectively use words to encode information. In particular, reading impaired children appear to have compromised ability to access or retrieve relevant information about verbal referents from semantic memory (Felton, et al. 1987; German, 1984; Wolf, 1984; Wolf & Goodglass, 1986). For example, impaired object naming, i.e., retrieval of nouns, has been found to correlate highly with the presence of reading disabilities (Felton, et al., 1987; German, 1984), and to predict later development of reading disabilities (Wolf, 1984; Wolf & Goodglass, 1986). The presence of anomia plus a deficit in at least one other aspect of expressive or receptive language, a "language disorder syndrome," characterized 63 percent of dyslexic children in one study (Mattis, 1978). In other studies, all of the reading impaired subjects were characterized by the presence of at least word-finding and/or naming deficits (Felton, et al., 1987;

Murphy, et al., 1988; Wolf & Goodglass, 1986).

The focus of recent research in dyslexia has been predominantly clinical with special attention directed toward issues related to diagnosis and remediation of reading disorders (e.g., Felton, et al., 1987; German, 1984; Murphy, et al., 1988; Wolf, 1984; Wolf & Goodglass, 1986). This emphasis may simply be the result of exhausting traditional methods of inquiry and a lack of innovative procedures for examining the theoretical relationship between language and reading skills. Nonetheless, as Geschwind asserted, it is important that the theory not be overlooked in favor of "concern for treatment," as "knowledge of the mechanism is [as] likely to advance diagnosis, prevention, and therapy" and, in fact, may prevent "many dyslexics and their families [from falling] prey to the popular fads that inevitably arise when adequately founded scientific knowledge is not available" (1985, p. 2). Thus, despite widespread recognition of the existence of a relationship between language and reading disabilities, the specific manner in which language skills and reading interact remains incompletely understood.

The purpose of the current research was to further elucidate the relationships among reading comprehension and accuracy, word retrieval, and receptive vocabulary with particular emphasis placed on the influences of

lexical class (i.e., nouns and verbs) on those relationships. This research was intended to expand upon the reasonably well-established findings from developmental language research of differential patterns of noun-verb acquisition and disruption. Accomplishment of these objectives entailed investigating word class differences in lexical knowledge and retrieval, and the relationship of these differences to reading ability in normal and reading impaired children. Differential patterns in noun and verb knowledge and retrieval exhibited by normal and impaired readers were expected to engender inferences about the influences of lexical access on reading proficiency.

The present research was comprised of two experiments. The goal of the first experiment was to devise sets of lexical stimuli for retrieval of nouns and verbs. The goal of the second experiment was to use those sets of stimuli, in conjunction with measures of reading and receptive vocabulary, to examine the relationship between noun and verb knowledge and retrieval and reading proficiency in normal and impaired readers.

Given the centrality of the theme that reading deficits are largely language-based and the important roles played by lexical class and word retrieval in this research, these topics will be discussed more fully before presenting the experiments themselves. First, the

influences of receptive and expressive language proficiency on reading will be summarized. Second, the rationale for studying lexical class differences will be explained by drawing together research findings from developmental and neuropsychology and psycholinguistics. Third, relevant research pertaining to confrontation naming and other word retrieval techniques will be presented. Last, lexical models of reading and word retrieval will be introduced to explicate the theoretical foundation for the central premises of this research.

Reading As A Language-based Disorder

Receptive Language Proficiency

Receptive language skills play an important role in reading. Failure to recognize a word as familiar or to appreciate the meaning of that word will interfere with reading comprehension. In fact, qualitative differences in receptive word knowledge have been correlated with reading comprehension, even among normal readers. Whereas contextual cues may not facilitate word identification among more skilled readers (Nicholson, 1991), context does appear to increase the efficiency with which readers assign meaning to the words they have identified by helping readers to differentiate between relevant and irrelevant word associations. For example, among normal

fifth graders, those students who had better reading comprehension skills appeared to use contextual constraints to focus on the most relevant aspects of a word's meaning; students less skilled in reading comprehension, in contrast, exhibited no greater attention to relevant than irrelevant associations to the target word in a sentence (Merrill, Sperber, & McCauley, 1981). Thus, poorer comprehenders, did not use "the meaning of the sentence as a whole" to "determine...the manner in which individual words and word concepts are encoded" (Merrill, et al., 1981, p.623). Similarly, university students less skilled in comprehending auditory, written, and pictorial information were characterized by their diminished tendency to "suppress...less relevant information," which resulted in their "building a [less] coherent mental representation" of the conveyed meaning than individuals with better comprehension skills (Gernsbacher, Varner, & Faust, 1990, p.440, 441). When reading, adults with poorer comprehension less efficiently suppressed "inappropriate meanings of ambiguous words...and the incorrect forms of homophones.... While viewing pictures with superimposed words [and while] reading words surrounded by pictures, less skilled comprehenders suppress[ed...cross-modal interference] less efficiently" (Gernbacher & Faust, 1991, p. 259-260).

Expressive Language Proficiency

Reading skill is correlated not only with efficiency and precision in conceptual or semantic representation of words, but with the precise and efficient expression of word knowledge, as well. Impaired readers exhibit "limited facility in using language to code other types of information" (Vellutino, 1987, p.34). The preeminence of language "coding" problems over visuospatial and visual memory problems in discriminating between normal and impaired readers is supported by the findings of two studies. Impaired readers performed significantly worse than normals when recalling printed nonsense syllables and series of meaningful and nonsense words, but performed comparably to normals on visual and sequential memory tasks in which stimuli did not readily lend themselves to verbal encoding, e.g., Kimura nonsense figures and Corsi blocks (Liberman, 1985). Similarly, impaired readers exhibited no greater difficulty than normal readers when copying English letters and words, learning visual paired associates, recognizing randomly-ordered unfamiliar Hebrew symbols, and reproducing geometric designs and Hebrew letters and words from memory. Normal readers outperformed impaired readers only with respect to expressive language skills, such as naming the letters or reading aloud the words they had recognized, reproduced, and recalled

(Vellutino, 1978).

The most prevalent expressive language deficits among impaired readers are deficits in "naming" or word-retrieval. Anomia, in fact, is a central criterion for the most frequently encountered subset of dyslexia described by Mattis (1978) as a "language disorder syndrome," i.e., the presence of anomia plus a deficit in at least one other aspect of expressive or receptive language. In some studies, virtually all children with reading impairments were characterized by the presence of word-finding and/or naming deficits. (Felton, et al., 1987; Murphy, et al., 1988; Wolf & Goodglass, 1986).

Different techniques have been offered to assess word-retrieval skills. Among those are four types of "naming" tasks: naming of pictured objects, naming to definition, naming to open-ended sentences (cloze procedure), and naming to touch (stereognosis). Compared with normal and non-dyslexic learning disabled peers, dyslexic children were significantly impaired in each of those four naming conditions (Rudel, Denckla, & Broman, 1981). Another word retrieval technique which has differentiated dyslexic from non-dyslexic children is rapid, repetitive naming of colors, numbers, letters, and familiar objects (Rapid Automatized Naming - R.A.N.; Denckla & Rudel, 1976). Repetitive naming is less automatic among dyslexic than non-dyslexic learning

disabled and normal children (Denckla & Rudel, 1976; Wolf, 1984). Story retelling tasks, similarly, elicited differences in word-retrieval between normal and reading impaired peers (Murphy, et al., 1988). Dyslexic subjects were "slower to produce words and produced fewer words and propositional units" than their non-dyslexic peers (Murphy, et al., 1988, p. 16).

Confrontation naming, i.e., retrieval of the names of items in the presence of those items (or pictured items), also a technique adopted from adult aphasia research, has been the most frequently used means of studying word-retrieval in normal and reading disabled children. In addition to a positive correlation between object naming and reading ability (Felton, et al., 1987; German, 1984), the early presence of object naming deficits has been found to predict later development of reading disabilities (Wolf, 1984; Wolf & Goodglass, 1986).

Synonym generation, i.e., eliciting a synonym in the presence of a target, is an infrequently used word retrieval technique. However, the salience of synonym generation in assessing lexical knowledge and the relationship between synonym generation and reading are suggested by the inclusion of a "Synonyms Subtest" in the "Word Comprehension" portion of the Woodcock Reading Mastery Tests - Revised (Woodcock, 1987). In this subtest,

the child must read a word aloud and then generate a synonym for it. Given the absence of pictorial context, the synonym generation technique may help to compensate for factors which potentially confound the use of picture naming tasks in the study of noun-verb retrieval. One such factor is that it may be more difficult to depict and possibly to interpret pictures of actions than of concrete objects. Moreover, as Kohn, Lorch, and Pearson pointed out, "the static depiction of actions in pictured form would seem to bias action naming tests toward eliciting noun-like representations" (1989, p. 58). A further potential confound is that pictures of actions typically convey more semantic information than pictures of objects, e.g., about the actor or agent and, in some cases, the object being acted upon. This additional contextual information may influence the word retrieval process in unpredictable ways; that is, it may either facilitate retrieval of the action name or serve as a distractor. Synonym generation has been introduced in aphasia research to study noun and verb retrieval following neurological damage (Kohn, et al., 1989). It has not yet been used to assess word-retrieval skills in reading disabled children.

Rationale For Studying Lexical Class Differences

Verbs are as important as nouns to the expression, understanding, and retention of language. Verbs and nouns contribute equally to sentence comprehensibility (Aaronson & Ferres, 1984; Healy & Miller, 1971) and meaning (Healy & Miller, 1970; Reynolds & Flagg, 1976). Verbs contribute more than nouns to the structure or organization of information into ideas (Aaronson & Ferres, 1984) and to the grammatical integrity of sentences (Healy & Miller, 1971). When matched for word frequency and imageability, verbs are remembered as accurately as nouns in free sentence recall, and serve as effectively as nouns in cuing sentence recall (Raeburn, 1979). Verbs are thought to be processed semantically more "deeply" than nouns (Reynolds & Flagg, 1976). That is, verbs "play an important role in the assignment of [underlying] meaning" in our understanding of sentences (Slobin, 1979, p. 50). Therefore, verb phrases appear to contribute even more readily to sentence comprehension than to verbatim recall (Aaronson & Ferres, 1984; Raeburn, 1979).

In addition to the implications of these findings with respect to the importance of verbs in reading comprehension, examination of verbs is further warranted in light of significant differences between nouns and verbs which have been identified in developmental,

psycholinguistic, and neuropsychological research. Specifically, studies of language development suggest that verbs are acquired later than concrete nouns and as a result of different aspects of the language development process (Camarata & Schwartz, 1985; Clark, 1983; Gentner, 1982; Luria, 1982; Nelson, 1982). Psycholinguistic research emphasizes differences between nouns and verbs in terms of organization and storage in the mental lexicon (Huttenlocher & Lui, 1979). Taken together, these factors imply that developmental delays, such as those postulated in cases of reading disability, could have a different effect on the acquisition of nouns and verbs. There is compelling evidence that reading and retrieval of nouns and verbs can be differentially affected by acquired neuropsychological disabilities (Marshall & Newcombe, 1966; Marshall & Newcombe, 1973; Miceli, Silveri, Villa, & Caramazza, 1984; Williams & Canter, 1987; Zingeser & Berndt, 1988; Zingeser & Berndt, 1990). There has been less research into the effect of developmental disabilities. Nevertheless, noun and verb reading were found to be compromised to differing degrees in one study of dyslexic children (Blank & Bruskin, 1984). In light of their relevance, the significant findings are now discussed in greater detail.

The Development of the Mental Lexicon:

Differential Acquisition of Nouns and Verbs

Children first develop a store of familiar concepts organized around their experiences with people and objects. These primitive concepts provide the framework on which children map words. According to Luria, development and experience enable the preschool-aged child's word-knowledge to progress from subjective, idiosyncratic representation of a target word to more conventional representation of the word in terms of its functions, attributes, and the concrete situations in which the object/action appears (Luria, 1982). Over time, lexical entries become multiply represented in cognition as "systems of phonetic, situational, and conceptual associations" (Luria, 1982, p. 85). From those associations, the child abstracts category membership and defines essential similarities, differences, and relationships between pairs of objects and between objects and actions. The expansion and development of the lexicon is, therefore, the product of both passive observation and active cognitive operations.

Most of children's early words are concrete nominatives or object referents, rather than verbs or other predicative word forms (Camarata & Schwartz, 1985; Clark, 1983; Gentner, 1982; Luria, 1982; Nelson, 1982). This finding is relatively robust, as evidenced by the

fact that the noun/verb discrepancy exists cross-culturally (Gentner, 1982), and in language-impaired as well as normal children (Camarata & Schwartz, 1985).

The generality of the noun-over-predicate superiority was supported by Gentner's compilation of data from her own and others' developmental research. Cross-cultural predominance of nouns in the early expressive and receptive language of children helped to refute the possibility that this was a phenomenon specific to the English language. Children learning Kaluli (a New Guinea tongue), German, Turkish, Japanese, and Mandarin Chinese consistently understood and produced more concrete nouns than predicative terms (Gentner, 1982). Frequency of exposure, word-order, morphological complexity, and patterns of language teaching could not individually account for the cross-cultural differences in noun-predicate acquisition. From these findings, Gentner concluded that the superiority of noun acquisition over predicate acquisition was due to conceptual rather than purely linguistic factors.

Comparison of the language production of language-impaired (2:8 to 3:4 year old) children and normal (1:5 to 2:1 year old) children provided further evidence of noun-over-verb superiority (Camarata & Schwartz, 1985). Both groups produced significantly more object than action words in spontaneous speech. Moreover, production of

object words was characterized by greater phonological accuracy than action words in both groups of children. In a second experiment, the researchers attempted to control for such potentially confounding variables as frequency of occurrence in input, position in sentence, differences in the phonetic composition of object and action words, and the variety of inflectional endings. Normal and language impaired preschool-aged children were trained in 10 sessions, at three 45-minute sessions per week, on a set of 16 low-frequency monosyllabic "experimental" words consisting of 8 action words and 8 object words (e.g., foam, gauge, flail, swoon). The words were selected on an individual basis so that half contained consonants (alone and in combination) spontaneously produced by the child, and half contained consonants not encountered in a 125-word sample of the child's spontaneous speech. On post-testing, for both groups of children, the experimental object words were produced more frequently and with greater accuracy than the action words. The researchers attributed the limited effect of training on the production of experimental action words to naturally occurring limits in attentional or processing capacity for language. The absence of qualitative differences in the performances of language impaired and normal children, suggested to the authors that the lexical organization of the two groups of children was comparable and that

differences in chronological age, experience, and general cognitive abilities did not account for their findings.

Two primary theoretical models have been put forth to describe the process by which children develop and refine their lexicon: the Functional-Core Model of Katherine Nelson (1982) and the Semantic Feature Hypothesis / Lexical Contrast Theory of Eve Clark (1983). The Nelson and Clark models differ in their interpretation of the child's primitive conceptualization. Nelson proposed that prelinguistic concepts are developed and modified around the child's awareness of the features, functions, and contexts associated with concrete objects (1982). She attributed children's earlier acquisition of nouns to the greater salience of objects in children's early experiences. Eve Clark (1983), in contrast, attributed children's later acquisition of verbs to inherent differences between objects and actions. Clark contended that children initially form concepts of objects by processing available visual-perceptual information, and particularly by noting the elements of perceptual similarity and contrast between one object and another (1983). Situations and the verbs which represent them, she argued, are more transitory, more diverse, and have less well-defined definitional boundaries than objects. They are, consequently, more difficult for children to

conceptualize, and therefore, to represent in words.

Research does not yet unequivocally support one model over the other. Luria's observations about the acquisition of word-meaning, for example, incorporated elements of both the Semantic Feature Hypothesis and the Functional-Core Model, but were more consistent with Clark's hypothesis. He found that "...substantive words (nouns)...are consciously understood before words denoting actions or qualities" (1982, p. 68). He further observed that highly motoric verbs were acquired earlier and were more easily conceptualized than passive verbs. This was particularly evident from the fact that elementary school children correctly classified as verbs those "verbs which clearly express actions (such as...to run, ...to walk, ...to chop)... [but] begin to waver when asked to characterize verbs expressing passive states, such as...to sleep, ...to rest ...to be ill. They are often unable to place these in a clear grammatical class" (Luria, 1982, p. 70).

Clark's and Luria's observations are consonant with the previously described observations of Dedre Gentner who postulated that children learn concrete nouns earlier than predicative terms including verbs, because nouns' "referents are more accessible [to children] than those of predicates" (1982, p. 321). While objects and their predications (including the actions and relationships

which characterize them) may be perceived equally early, children demonstrate greater difficulty "packaging and lexicalizing" the predications than the objects (Gentner, 1982, p. 326). This difficulty, Gentner argued, is due to a naturally and universally occurring "perceptual-conceptual distinction between concrete concepts such as persons or things and predicative concepts of activity, change-of-state, or causal relations" (1982, p. 301). She referred to this difference as the Natural Partitions Hypothesis. Gentner contended that concrete nouns are less conceptually complex as a function of their relative consistency and their readily identifiable physical parameters.

The Mental Representation of Nouns and Verbs

The manner in which words are semantically encoded has been thought to influence the efficiency with which those words can be retrieved, and several models of semantic encoding and organization have been proposed. In this study, we will not be examining particular models of semantic organization because those that address the noun-verb differential do so in a cursory way. Nevertheless, a limited number of models have implied that nouns and verbs are represented differently in the mental lexicon; these models warrant further mention.

The mental lexicon was envisioned in one model as a

repository of randomly stored words, organized primarily in relation to the age at which they were acquired, with earlier-learned words more rapidly accessible than those acquired more recently (Carroll & White, 1973). This model implied that longer latencies would be required to access verbs than to access early-acquired concrete nouns.

More recent models suggested that semantic information was organized categorically and hierarchically (McKenna & Warrington, 1980) and/or according to structural properties of the referent, functional and associative relationships between the referent and other objects, events and properties, and phonological representation of the referent's name (Humphreys & Riddoch, 1988; Humphreys, Riddoch, & Quinlan, 1988; Riddoch, Humphreys, Coltheart, & Funnell, 1988). One model specifically addressed differences in the semantic organization of nouns and verbs as a function of their different conceptual dependency on one another (Huttenlocher & Lui, 1979). Objects were thought to be hierarchically linked in semantic memory in relation to perceptual and functional features; that is, in relation to conceptual or categorical relationships (e.g., birds, living things, features of nature) and shared properties (e.g., size, presence of feathers). Objects were said to be encoded in memory "independently of their actions" (Huttenlocher & Lui, 1979, p. 155). Verbs, in contrast,

are encoded in "matrix-like" fashion, in terms of complex interrelationships with "relatively uncorrelated" subjects, direct objects, and the number and type of noun arguments they imply, as well as in relation to semantically similar verbs. "Accessing of meaning" is influenced by the number and type of lexical connections activated between the presentation of one word and the next (Huttenlocher & Lui, 1979, p. 156). In the authors' view, "if only the most central aspects of meaning were activated when a word was presented, concrete nouns would...access related nouns, but verbs would access only their noun arguments" (Huttenlocher & Lui, 1979, p. 158).

Each of these models permits some degree of selective interference i.e., disruption to specific portions or paths of semantic access. Thus, differences in semantic organization and conceptual linkage between nouns and verbs make possible some degree of word-class-specific impairment by developmental or acquired language deficits.

Differential Deficits in Noun and Verb Retrieval in Neurologic Disease

Much of the research about differential deficits in noun and verb finding has focused on acquired, rather than developmental, language and reading problems (aphasia and alexia). Although the quantity of relevant research is limited by the longstanding emphasis on object referents

to the near exclusion of research on verb finding, there is evidence that noun retrieval and verb retrieval can be affected differentially by acquired brain damage.

Anomia Research

The prevalence of nouns over verbs in the spontaneous speech of anterior aphasics has been well documented (e.g., Williams & Canter, 1987; Zingeser & Berndt, 1990) and has suggested differential preservation and disruption of language along word-class lines. Despite relatively preserved general intelligence, receptive vocabulary (PPVT), memory, attention, and orientation, one patient with probable progressive dementia exhibited category specific language deficits defined by poorer comprehension and expression of verbs than nouns (McCarthy & Warrington, 1985). He exhibited a paucity of substantive verbs in spontaneous speech, impaired confrontation naming of verbs despite normal object naming, and greater difficulty discriminating between similar verbs (eat vs. drink) than similar nouns (seal vs. walrus). Broca's, Wernicke's, anomic, and conduction aphasics studied by Williams and Canter (1987) all demonstrated poorer action naming than object naming. A noun-verb retrieval differential was also suggested by a study comparing synonym generation by normal adults and a small, heterogeneous sample of aphasics (Kohn, et al., 1989). In

that study, subjects were instructed to generate a single synonym upon written and auditory presentation of each noun or verb target word. Aphasic subjects exhibited poorer synonym generation in general than normals and, when intrasubject noun-verb differences were detected, noun-generation was superior to verb-generation. In that study, as well, there appeared to be no relationship between type of aphasia (fluent vs. nonfluent) and the subject's performance.

Other studies have suggested that dissociation between object and action naming of aphasic subjects may be dependent upon the specific location of their dominant hemisphere lesions. One study compared a small sample of patients with anomic (posterior) and agrammatic (frontotemporal) aphasia (Miceli, et al., 1984). The patients with anomic aphasia were reported to have greater difficulty naming pictured objects than actions; in contrast, action naming was more impaired than object naming in patients with agrammatic aphasia. In addition to poorer verb retrieval in confrontation naming, a group of agrammatic (anterior) aphasics demonstrated poorer verb retrieval than anomics and normal controls when naming to definition, describing action scenarios, and narrating a well-known fairy tale (Zingeser & Berndt, 1990). A patient with anomic (posterior) aphasia, in contrast, demonstrated poorer object naming than action naming (Zingeser &

Berndt, 1988).

The findings from all of these studies are somewhat equivocal and should be interpreted with caution because of the small sample sizes, presence of overlapping lesion sites, and inconsistencies in ensuring the comparability of noun and verb retrieval measures. Nonetheless, these findings of differential disruption of noun and verb retrieval following acquired brain damage contribute to the rationale for investigating word class differences in developmental cognitive disorders.

Alexia Research

In contrast with equally impaired noun and verb reading by the anomie patient studied by Zingeser and Berndt (1988), three studies of patients with acquired aphasia and/or alexia revealed differential reading impairments for words in different grammatical categories. In one study of aphasic and alexic subjects, "long non-nouns" (e.g., verbs and adjectives four to eight letters in length) and abstract nouns elicited more reading errors than words from other grammatical classes (Gardner & Zurif, 1975). "Short picturable nouns," in contrast, elicited the fewest reading errors. The patient described earlier as having a category-specific language deficit exhibited more errors when reading verbs and function words than nouns and non-words (McCarthy & Warrington,

1985). Another patient studied approximately 20 years after a gunshot wound to the left temporal and parietal cortex demonstrated significantly greater difficulty reading verbs and adjectives than nouns (Marshall & Newcombe, 1966). He correctly read 45% of nouns, 16% of adjectives, and only 6% of verbs presented (p. 172). Moreover, his errors varied with the grammatical class of the target word as well. Noun errors predominantly consisted of semantic substitutions (LIBERTY read as "freedom") (Marshall & Newcombe, 1966, p.171). Verb errors, in contrast, were predominantly "visual" errors, i.e., errors based on visual similarity with the target word (e.g. NEXT read as "exit," GENTLE read as "gentleman") (Marshall & Newcombe, 1966, p.171). Object naming was slow but relatively error-free; color naming was impaired. In a later paper, the same authors described the reading of five additional patients with acquired dyslexia (Marshall & Newcombe, 1973). Three of the five exhibited better reading of nouns than verbs. Two of those three patients also exhibited intact object naming, as did the two patients with comparable noun and verb reading skills. No attempt was made in either study to assess action naming.

Research With Dyslexic Children

To the author's knowledge, confrontation naming of

verbs has never been studied in reading impaired children. The potential value of such a focus has been suggested by German's contention that "evaluations assessing word retrieval of [non-nouns, including verbs]...may result in a more realistic appraisal of a child's word-finding skills" than assessment of noun retrieval alone (German, 1984, p. 354).

Two studies examined the effects of word class, i.e., nouns, verbs, and noncontent words (prepositions, conjunctions, auxiliary verbs), on children's reading and spelling performances (Blank & Bruskin, 1984; Bruskin & Blank, 1984). In addition to finding that non-content words were more difficult to read than content words (i.e., nouns and verbs) for all but the best readers, the authors suggested that reading skills may differ depending upon the specific part of speech of the content words (Blank & Bruskin, 1984). They studied word identification latencies and error patterns in sixteen male dyslexic subjects (mean grade 5.7; mean age 11.2 years). The subjects were presented with a list of 16 nouns, 16 verbs, and 16 "noncontent" words (e.g., prepositions, articles, conjunctions). The lists for each class of words were matched for frequency of appearance in text at the third grade level and for number of syllables. Normal third and fifth grade children, aged 8 to 11 years, read nouns and verbs with comparable accuracy. Dyslexic fifth grade

subjects, in contrast, made more single-word reading errors on verbs than nouns (Blank & Bruskin, 1984). Word class differences in orthographic access were further suggested by the fact that even normal readers made more errors when spelling verbs than nouns (Bruskin & Blank, 1984).

Differential Noun-Verb Contribution to Sentence Meaning and Memory

Fluent comprehension of spoken and written language is an active process which depends on efficiently accessing semantic memory for relevant information about verbal referents and holding that information in short term memory long enough to meaningfully relate sentence components to one another (Blank & Bruskin, 1984; Slobin, 1979; Vellutino, 1987). Nouns and verbs have been found to contribute importantly and differently to sentence comprehension and memory. Such findings further support the relevance of studying both noun and verb retrieval in children with reading impairments.

Differential Contribution To Meaning And Structure

Several studies have attempted to define the relative contributions of nouns and verbs to sentence meaning and the relationship between those contributions and organization of the mental lexicon. One early study

compared the extent to which nouns and verbs contributed to the "meaning" of written sentences. Subjects were instructed to sort 20 target sentences into piles "on the basis of similarity of meaning so that the sentences that are closest together in meaning are in the same pile" (Healy & Miller, 1970, p. 372). The target sentences used all possible combinations of five nouns [salesman, critic, writer, student, publisher] and five verbs [sold, criticized, wrote, studied, published] in the form "The [NOUN] [VERB-ed] the book." The "piles" were defined by the five "most plausible" sentences, i.e., those in which the noun and verb matched (e.g.: "The salesman sold the book."). Fourteen of the 15 adult subjects sorted the sentences "by verbs" so that each pile consisted of sentences with identical verbs. From this, the authors concluded that verbs were "more closely linked" to the "meaning" of active sentences than nouns (p. 372). Based on these findings, the authors anticipated that the absence of main verbs would diminish comprehensibility more dramatically than the absence of main nouns. However, a subsequent study revealed that missing nouns and missing verbs affected sentence comprehensibility to the same extent (Healy & Miller, 1971). Sentences in which the main verb was missing were, however, judged to be less "acceptable" (i.e., less "what a well educated speaker of English might say") than sentences missing the subject

noun (Healy & Miller, 1971, p.96). The researchers concluded that the main verb is more important than the main noun to the "grammatical integrity...of a sentence, but not necessarily more essential to the meaningfulness or comprehensibility of the sentence," per se (Healy & Miller, 1971, p. 95).

A more recent series of studies concurred that the "various lexical categories contribute differentially to the syntax and semantics of the sentence, and to the cognitive processing of 'structure' and 'meaning'" (Aaronson & Ferres, 1984, p. 21). In general, "content words," (i.e., both the main nouns and main verbs) contribute to the specific meaning of the sentence (Aaronson & Ferres, 1984). However, the noun was found to contribute more significantly to "specific meaning;" whereas, the verb "relates the sentential subject to the object, or to a predicate complement" (Aaronson & Ferres, 1984, p. 23, 34). More specifically, the verb often aids comprehensibility by providing the reader or listener with clues about the number of and relationship among noun arguments (Aaronson & Ferres, 1984).

The contribution of verbs to sentence meaning was further elucidated by a series of studies of the synonymy of nouns and verbs (Reynolds & Flagg, 1976). Adult subjects exhibited difficulty discriminating between verb phrases to which they had been previously exposed and

new phrases which differed only by the presence of a synonym for the main verb. Significantly less difficulty was observed for phrases containing subject or direct object synonyms. Successive experiments ruled out the contribution of differences in concreteness or abstractness of the sentences and word frequency count. Similar findings persisted in a sentence recognition task even when "orthographic and derivational" differences and differences in degree of synonymity between nouns and verbs were minimized by including only nouns and verbs which were derivationally related (e.g., "sprinter/sprinted," "racer/raced") and which were judged by a pool of 24 subjects to have a high degree of similarity to their respective synonyms (Reynolds & Flagg, 1976, p. 428). In a subsequent experiment, subjects were asked to rate the degree of similarity of verbs and nouns to their respective synonyms when embedded in sentences. In contrast with the comparable similarity of those words in isolation, sentences containing synonymous verbs were rated as more similar to one another than those containing noun synonyms (Reynolds & Flagg, 1976). The authors proposed a "semantic encoding model" to explain these findings. They speculated that "a complex processing interaction occurs at comprehension time. Verbs are processed to a deeper semantic level and nouns have the form information encoded more strongly" (Reynolds & Flagg,

1976, p. 430).

Differential Contribution To Memory

Nouns and verbs serve as equally effective cues for sentence recall when linguistic variables, such as word derivation, frequency, and imaginability, are controlled (Raeburn, 1979). Nevertheless, nouns and verbs seem to contribute differently to memory for sentences. It has been suggested both in early psycholinguistic research, thoroughly reviewed by Reynolds and Flagg (1974) and Raeburn (1979), that verbs play an important role in tasks demanding recall of sentence meaning or "gist"; whereas, nouns are more integral in verbatim recall tasks. Subjects in one study were exposed to identical target sentences presented either in isolation or at the end of a paragraph which subjects were told "would facilitate sentence recall" (Raeburn, 1979, p. 138). Recall protocols were scored for recall of subject nouns, verbs, and direct objects, with precise recall and recall of acceptable synonyms both judged as correct. In the isolated sentence recall condition, recall of both subject and object nouns was significantly better than recall of verbs. In the paragraph context condition, the mean differences between subject nouns and verbs recalled decreased markedly. The author surmised that presentation of a recall task in a manner resembling a comprehension task increased "the

importance of the verb in a memory task" to a level more comparable to its importance in sentence comprehension tasks (Raeburn, 1979, p. 138). One finding not addressed by the author was that, while both noun and verb recall were weaker in the context condition than in the sentence condition, mean recall of main verbs differed less markedly than that of nouns. This finding appears consistent with the semantic encoding model described above (Reynolds & Flagg, 1976), in which verbs are said to be processed more "deeply," i.e., with more direct evocation of meaning, than nouns. One might surmise that the depth of semantic processing facilitated retrieval of target or synonymous verbs.

The proportion of time spent reading noun and verb phrases of similar length was compared in comprehension and recall tasks (Aaronson & Ferres, 1984). Reading comprehension tasks (tested by responding to yes/no questions) and reading recall tasks (tested by writing the sentence from memory) were administered by computer, one word per screen, at a rate determined by the subjects themselves. Mean reading times for main nouns were identical under both recall and comprehension conditions, and were virtually identical to main verb reading times under the comprehension condition. Under the recall condition, however, when the task demand for verbatim recall was presumably greater, verb-reading time was

significantly longer. The authors concluded that the "structural information" conveyed by verbs "is more important when reading for retention than for comprehension of gist" (Aaronson & Ferres, 1974, p. 54). While this may be the case, it appears more reasonable, within the context of other literature reviewed here, to surmise that readers compensated for the "deeper" processing of verbs (i.e., by direct integration of meaning rather than retention of the specific verb) by focusing more attention on this element of the sentence, during verbatim recall tasks.

Confrontation Naming

The Relationship Between Confrontation Naming And Other Language Skills In Normal Children

Historically developed for use with adults to assess acquired language deficits, the confrontation naming technique has been more recently extended to children, to evaluate developmental language disorders. Although use of confrontation naming tests with children had, until recently, been hampered by the "lack of developmental norms" for naming and other language tests and the scarcity of "information regarding the relationship between [various language] measures" (Halperin, Healey, Zeitchik, Ludman, & Weinstein, 1989, p. 518), Halperin and

his colleagues (1989) demonstrated that the scores of 241 normal, 6- to 12-year-old children on the Boston Naming Test (BNT) increased significantly by age cohort and were, therefore, presumably correlated with stage of language development. Moreover, when controlled for age, BNT scores were found to be correlated with scores on other language and verbal learning measures, *viz.*, the Peabody Picture Vocabulary Test-Revised (PPVT-R), Wechsler Paired Associate Learning (Hard Pairs), and Verbal Fluency ("sh" cue) (Halperin, et al., 1989). Despite the statistical significance of these correlations, most correlated measures accounted for relatively little of the variance in scores. To more precisely identify the functions measured by the components of their language battery, Halperin and his colleagues submitted normal children's scores on the BNT and other language and verbal memory measures to factor analysis. That analysis identified three independent factors which, together, accounted for almost 70 percent of the variance in language scores. Based upon the data with these normal children, the BNT and PPVT-R clustered separately from other measures representing verbal fluency and verbal memory in a factor to which the authors referred as "word knowledge or vocabulary" (Halperin, et al., 1989, p. 527).

Confrontation Naming In Children

With Reading Impairments

Confrontation Naming And Other Language Measures

Despite the strongly predictive relationship between the BNT and PPVT-R scores of normal children (Halperin, et al., 1989), that interrelationship appears to weaken in the presence of learning disabilities. Wolf and Goodglass (1986) found no significant differences in PPVT-R scores between severely impaired readers and normally achieving readers, suggesting that deficits in receptive vocabulary were not a significant correlate of reading disability. In contrast, the Boston Naming Test scores of impaired and normal readers differed significantly.

Felton and her colleagues (1987) administered a battery of language and verbal learning tests to 98 reading disabled and non reading disabled children. PPVT-R and BNT scores were highly correlated for all children. However, removal of PPVT-R score as a covariate did not diminish the significant differences in BNT scores between reading disabled and non reading disabled subjects. Similarly, when the effect of PPVT (1965 edition) was partialled out significant correlations remained between kindergarten and first grade performances on the Boston Naming Test and second grade reading measures (Wolf & Goodglass, 1986). In contrast, when the effect of the

BNT was partialled out, the PPVT no longer emerged as a significant predictor of reading ability. From this low combination of correlations they surmised that the relationship between naming and reading was not merely attributable to vocabulary knowledge (Wolf & Goodglass, 1986).

Murphy, Pollatsek, and Well (1988) compared the performances of 28 "good" and "poor" readers on a battery of language tasks. Their subject groups were matched for age (10 to 11 years) and IQ. In addition to between-group differences in Boston Naming Test scores, significant between-group differences in accuracy and latency were found on a second object naming task. That measure was an 84-item test derived from pictures standardized on an adult sample for name agreement, image agreement, familiarity, and visual complexity (credited to Snodgrass & Vanderwart, 1980). Despite significant between-group differences in naming the objects in the latter task, Murphy and her colleagues found no significant differences between dyslexic and normal subjects in categorizing those same pictures. Consequently, the authors attributed picture naming deficits to "difficulty in accessing phonological codes (i.e., a problem specific to language)" rather than to a generalized cognitive deficit (Murphy, et al., 1988, p.4).

Confrontation Naming In Screening For Dyslexia

In the study cited above, Murphy and her colleagues (1988) found that performances on the Boston Naming Test were significantly correlated with single-word recognition and reading comprehension scores in normal and reading disabled children. Significant differences were found between naming scores of reading disabled and non reading disabled children in another study; whereas, no such differences were found between attention deficit disordered and non-ADD children (Felton, et al., 1987). Evidence of a correlation between confrontation naming and reading abilities has suggested that naming tests may be instrumental in screening for the presence of language-based reading disabilities.

The predictive value of confrontation naming was, in fact, demonstrated in a three-year longitudinal study assessing the relationship between naming and reading (Wolf, 1984; Wolf & Goodglass, 1986). A sample of 98 children were assessed in kindergarten, first, and second grade. Kindergarten and first grade performances on the (85 item experimental) Boston Naming Test and on other naming measures, i.e., Rapid Automatized Naming Test (Denckla & Rudel, 1976) and Wolf's own Rapid Alternating Stimulus naming test, were significant predictors of Grade 2 reading accuracy and comprehension. Wolf's findings led her to conclude that "the naming methodology

can be as important in the study of the dyslexias as it has proven to be in the adult aphasia" (1984, p. 113).

Limitations Of Existing
Confrontation Naming Research

Despite the consistent correlation of confrontation naming tests with reading impairments and, presumably with underlying acquired language deficits, the validity and reliability of these word-retrieval measures for use with children have not yet been demonstrated. For the most part, the tests which predominate in the literature, i.e., the Boston Naming Test, in its original 85-item and revised 60-item formats (Kaplan, Goodglass, & Weintraub, 1978), and the meticulously researched Snodgrass and Vanderwart object naming items (1980), were developed for use with adults, standardized on adults, and introduced to children with minimal or no revisions. That is, no stringent psychometric analysis has been employed to ascertain and enhance the items' appropriateness in a word-retrieval measure for children. Some of the factors which appear important in the development of word-retrieval tests will be discussed further.

Confrontation naming measures used with children have exclusively examined object naming. Based upon important differences between nouns and verbs in development, organization, and interpretation of language, examination

of object naming alone "may ignore potential word-finding difficulties in other semantic categories" (German, 1984, p. 354), and thus provide an incomplete or biased picture of a child's naming and language skills.

Important Considerations In Development Of Word Retrieval Stimuli

Some aspects of stimuli used to elicit object naming and of object naming referents themselves have been found to influence the accuracy with which objects are named. Factors which have proven relevant in object naming have been considered in this research in the development and adaptation of test stimuli for use with children. The most pertinent findings regarding the nature and quality of confrontation naming stimuli will be highlighted.

The Perceptual Quality Of The Stimulus

The perceptual clarity of the stimulus has been found to influence the accuracy of confrontation naming. In an early examination of the impact of perceptual information on naming, naming accuracy by anomic patients declined significantly with progressive decreases in the amount of perceptual detail available (Bisiach, 1966). Specifically, naming was most accurate in response to color photographs, less accurate in response to line drawings, and least

accurate in response to partially obscured line drawings of objects. This would appear to suggest that stimuli drawn with greater detail could elicit more accurate naming than more starkly depicted stimuli. Nevertheless, more recent research suggests the relationship between the perceptual quality of the stimulus and naming accuracy may not be so straightforward. For normal adults and nondegraded stimuli, the "visual complexity" of a pictured object was found to be a function of properties inherent in an object itself and in its usual setting, rather than of artistic style (Snodgrass & Vanderwart, 1980, p. 187). With respect to the present research, it is possible that action naming stimuli and verb referents themselves could convey more information than nouns and object naming stimuli. It is virtually impossible to depict an action in isolation, i.e., without including the agent and object of the action. Most concrete objects, in contrast, can be depicted out of context. Moreover, psycholinguistic research suggests that verbs themselves activate a richer, more complex network of semantic associations than nouns.

Characteristics Of The Referent

Extensive normative data have been collected on several aspects of printed words, including frequency of occurrence in print, age of acquisition, concreteness, meaningfulness, and subjective familiarity (e.g., Carroll,

Davies, & Richman, 1971; Carroll & White, 1973; Gilhoolie & Logie, 1980; Klee & Legge, 1976). These data have frequently been used to rank or to determine comparability of pictorial stimuli used in confrontation naming tasks.

Word frequency and age of acquisition have been found to significantly affect naming latency and accuracy by aphasic, brain-damaged, and demented subjects (e.g.: Barton, Maruszewski, & Urrea, 1969; Carroll & White, 1973; Feyereisen, Van der Borgh, & Seron, 1988; Gardner, 1973; Kirshner, Casey, Kelly, & Webb, 1987; Shuttleworth & Huber, 1988). The subjective familiarity of a stimulus, however, appears to be the quality most predictive of accuracy in lexical tasks, especially for low frequency words (Gordon, 1985).

In light of what has already been said about the relationship between perceptual quality of the stimulus and naming, one must be cautious about simply applying normative data for printed words to pictorial stimuli. To address this problem, Snodgrass and Vanderwart (1980) collected data on normal adults' judgments about line drawings of 260 objects. In particular, they studied familiarity, visual complexity, and resemblance of the drawing to subjects' mental image of the referent. Moreover, they attempted to correlate their data with existing age-of-acquisition and word frequency information. They confirmed the salience of subjective

familiarity as a determiner of naming accuracy for normal adults and hypothesized that the most frequently encountered words, and those learned at the earliest ages, represent objects which are the most subjectively "familiar." Subjective familiarity, in fact, was significantly and positively correlated with word frequency (transformed by its cube root to compensate for the inclusion of relatively few high frequency items) and negatively correlated with age of acquisition (Snodgrass & Vanderwart, 1980).

Unfortunately, no evidence has become available as to the applicability of these findings to children. Furthermore, no comparable normative studies have been published regarding action naming stimuli. Consequently, there is still much which is unknown about whether object naming findings can be generalized to other subject groups or other types of stimuli.

Lexical Models Of Reading And Retrieval

The correlation between deficits in reading and deficits in word retrieval does not, of course, imply that deficits in one process cause deficits in the other. Rather, it suggests that the reading and retrieval processes overlap in critical ways. The most likely explanation for the correlation is that reading and word

retrieval are dependent upon some shared process or ability, and that relative impairments in that process or ability concurrently contribute to both reading and word retrieval problems. The present research is founded on the premise that the "shared" process or ability is in the domain of semantic or lexical access and/or content. The nature of this "overlap" will be examined by way of discussion of compatible models of reading and naming. First, the nature and organization of "semantic memory" will be discussed.

Semantic Memory

Semantic memory or the mental lexicon is the system "in which words are represented [in]...and manipulated by the brain" (Buckingham, 1981, p. 183). "Semantic memory," according to Tulving, is "a mental thesaurus" comprised of "organized knowledge a person possesses about words and other verbal symbols, their meaning and referents, about relations among them, and about rules...for the manipulation of these symbols, concepts, and relations" (1972, p. 386). The model best supported by lexical decision research, in which subjects must decide whether a stimulus is a real word or nonword, depicts each word entry as represented once in a metaphorical "master lexicon" (Forster, 1978). Word entries are linked to one another in a matrix of "phonetic, situational, and

conceptual associations" (Luria, 1982) and are retrievable through a number of different "peripheral access files" (Forster, 1978). Once cued or activated, each type of associative relationship represents a route through which the entry, and associated or related words, may be accessed and retrieved. Word retrieval errors are believed to occur as a result of deficits in accessing semantic storage and/or a result of the absence or loss of information in semantic memory itself (Riddoch, et al., 1988).

One perspective on semantic organization has its roots in the work of linguist Roman Jakobson (1956, 1963). Jakobson's focus on "contiguity" and "similarity," or "syntagmatics" and "paradigmatics," as the basis of semantic organization has been preserved in recent models of semantic representation (e.g., Buckingham, 1981; McKenna & Warrington, 1980; Nelson, 1982). For an adult, entries in semantic memory are associated both paradigmatically and syntagmatically (Buckingham, 1981; Nelson, 1982). Words organized syntagmatically are associated through their contiguity in time and space (Buckingham, 1981). Typical syntagmatic associations include: adjective-noun sequences (e.g.: "cold" and "weather"); commonly linked sentences (e.g.: "My uncle is a good wrestler."); item-location relations (e.g.: "boat" and "water"); instrument-function relations (e.g.: "watch"

and "for telling time"); words related through co-existence or customary association (e.g.: "needle" and "thread") and part-whole relationships (e.g.: "referring... to a television by the word tube or a car by the word wheels") (all examples are from Buckingham, 1981). In contrast, words associated paradigmatically are grouped into sets or "semantic fields" on the basis of their similarity (Buckingham, 1981, p. 185). Distinct semantic fields representing animate and inanimate objects, color-names, kinship terms, and temporal and spatial relations have been identified (McKenna & Warrington, 1980). Entries may be associated not only by semantic similarity or similarity of function but through orthographic, phonological, and morphological similarity, as well (Buckingham, 1981; Forster, 1978; Luria, 1982). In addition, words may be further organized hierarchically within specific categories (Buckingham, 1981).

In children, semantic memory is initially organized around "syntagmatic associations," i.e., associations of contiguity (Nelson, 1982). That is to say, actors, objects, descriptors, and events initially acquire meaning and become associated with one another within the contexts or situations in which they were experienced. Representation of word meanings becomes more adult-like only when children develop sufficient skills in verbal abstraction to identify paradigmatic relationships between

actors, objects, descriptors, and events, i.e., associations based upon similarity (Nelson, 1982). Thus, one might expect children with developmental language deficits to have relative difficulty accessing words based on paradigmatic similarities of semantic, phonological, morphological, and orthographic features.

A Model Which Links Reading And Naming

One promising information processing model defines reading as a multi-"route" process in which the "orthographic form" of the written word is simultaneously associated with its "phonological, ...morphological, and... semantic representation" (Marshall, 1985, p. 57). Although Marshall does not specify the system from which these representations of words are retrieved, its function appears to be compatible with the system naming and language theorists have termed semantic memory or the mental lexicon.

According to this model, the three "routes" to word identification, i.e., the "phonic route," "direct route," and "lexical" or "lexicosemantic route," "operate in parallel to assign sound, form, and meaning" to the written word (Marshall, 1985, p. 57; 1989). In the phonic route, "early visual analysis" lends itself to letter recognition, and to segmentation of words into "graphemic chunks" or phonemes. The phonemes are analyzed in relation

to rules of grapheme-phoneme correspondence and are then "blended" into an "articulatory code" the output from which is the pronunciation of the word. In the direct route, "early visual analysis" leads to the recognition and pronunciation of whole words without reliance on either segmentation of the word into smaller phonemic components or semantic interpretation of the word. The lexical or lexicosemantic route entails segmentation of the whole word into its "morphemic constituents," i.e., apparent word bases, prefixes, and suffixes. The morphemic constituents are, then, interpreted semantically and assigned a phonological representation (Marshall, 1985, p.57-60). In both the direct and lexical routes, phonemic output is processed through an OWR ("Output Word Representation") stage to a "response buffer" which permits overt articulation of the word.

Although all word identification routes are said to operate simultaneously, some routes are more efficient than others, and different routes are more efficient for readers of different skill levels. For good readers, comprehension of written material depends upon "fluency" or automaticity in word identification as "a basic prerequisite" (Vellutino, 1991, p. 442). Fluent readers predominantly use direct and lexical routes for their most efficient reading. Yet, even fluent readers depend upon the phonic route when confronted with an unfamiliar word

(Marshall, 1989). In contrast, the phonic route is the predominant route of young, inexperienced readers, i.e., readers who have a limited sight vocabulary and/or limited experience identifying word roots, prefixes, and suffixes. Such readers often break words down phonologically (into component sounds) and use the sound "code" rather than the word's orthographic "code" to guide word recognition. This technique is illustrated by younger children (Doctor & Coltheart, 1980) and adults with poorer Nelson-Denny reading comprehension scores (Daneman & Stainton, 1991) who exhibited more frequent "homophone confusion" errors than better readers on proofreading tasks. From the failure to recognize that sentences were nonmeaningful when inappropriate homophones were substituted for an appropriate word, the subjects were thought to rely more on phonological representation than orthography, irrespective of spelling ability. Less skilled readers, in addition, rely more upon contextual cues than better readers. More specifically, they depend upon sentential context to refine their identification of words in text and to narrow their word identification choices. Nicholson (1991), for example, found that less skilled and younger readers demonstrated fewer errors when reading words in context than when reading those same words in a list.

The reliance of less skilled readers on phonological recoding and context, while helpful, constitutes a less

than perfect compensation. Contextual cues often fail to provide sufficient information to facilitate comprehension (Nicholson, 1991). Moreover, less skilled and younger readers are characterized by difficulty associating orthographic symbols with corresponding sounds and blending those sounds to form words, thus making their ability to phonologically recode the written text unreliable (Vellutino, 1987).

It was Marshall's expectation that children with developmental reading deficits would be characterized by deficits "in one or more [of the] routes" by which the orthography, "sound, form, and meaning" of written words become associated (Marshall, 1985, p.57). Clinical evidence supports Marshall's expectations. It is not unusual to observe in some reading impaired children a particular deficit in applying rules of grapheme-phoneme correspondence and sound-blending. In other impaired readers, there appear to be relative deficits in word-recognition skills. In still other readers, weaknesses may be observed in interpreting the meaning of words they have correctly read, or in attention to prefixes, suffixes, and word-roots. Thus, Marshall's model seems to both describe the reading process plausibly and to account for some clinically observed reading phenomena.

The Marshall model bears a striking resemblance to processes described in models of word retrieval or naming.

Models of naming generally identify a limited number of steps necessary to retrieve the name of a pictured object from the mental lexicon or semantic memory. First, one must perceive the stimulus. The perceptual integrity of the stimulus has been positively correlated with accuracy in naming, particularly among subjects with generally weak naming or visuo-perceptual skills (Bisiach, 1966; Kirschner, et al., 1987). The process of perception in naming may be considered akin to the process Marshall described as "early visual analysis." Next, the stimulus must be recognized, either directly, by matching with stored prototypical images of familiar objects (Tsvetkova, 1975), or by comparison with stored semantic and functional attributes of known objects (Berndt, Caramazza, & Zurif, 1983; Caramazza, Berndt, & Brownell, 1982). The former may be considered parallel to Marshall's "direct route" of word identification, through which words are recognized holistically. The latter appears to parallel the "lexical route" in which the meaning and function of a word's constituent parts are analyzed. Once the object is identified, its "semantic representation" is "mapped" onto "a particular lexical item, that is, the word that is its name" (Caramazza & Berndt, 1978, p. 901). In the final "production stage," the lexical representation is translated into a "set of motor commands that make possible the articulation of the correct

phonological sequence (Caramazza & Berndt, 1978, p. 901). These steps are comparable to the process described by Marshall as a "feedback loop from OWR [Output Word Representations] [through] semantic representations (SR)" to a "response buffer...where the final triggering of the articulatory system...takes place" (1985, p.59). The similarities between models of reading and naming support empirical evidence that failures in the reading process coincide with comparable deficits in the naming process.

As compatible as it seems with some clinical observations of reading impairments and with a model of naming, Marshall's reading model does not, itself, explain clinical observations that some children appear to have more difficulty reading verbs than nouns, nor does it specifically support observed and documented cases in which "content" words are read more accurately than "function" words. To support those findings, it is necessary to invoke previously discussed notions about the word class differences in semantic processing and representation. The "deeper semantic processing" of verbs than nouns (Reynolds & Flagg, 1976, p. 430), and verbs' more syntagmatically organized semantic association network (Huttenlocher & Lui, 1979) may demand a more active paradigmatic lexical search strategy to associate the orthographic, pictorial, and phonological representations of verbs with one another and with their

semantic representation. Moreover, if semantic memory is organized in relation to the age at which words were acquired, words acquired at an earlier age, e.g., nouns, may be accessed more rapidly and reliably than later-acquired words, e.g., verbs (Carroll & White, 1973).

Focus Of The Present Research

Similarities between models of reading and naming suggested that both reading and word retrieval are dependent upon efficiently accessing information from the mental lexicon or semantic memory. Existing research has provided evidence that nouns and verbs are acquired at different stages of development and, once acquired, are organized differently in the mental lexicon. Such differences appear to be implicated in word class differences in reading and retrieval documented in some cases of acquired anomia and alexia.

Research has not yet meaningfully addressed whether developmental deficits, such as language-based reading impairments, result in differential disruption of noun and verb reading and retrieval. In fact, the research into word class differences in dyslexia is limited to a single study in which impaired readers exhibited less accuracy in reading lists of verbs than nouns (Blank & Bruskin, 1984). Although that study was flawed by the use of target words

so easy that relatively few errors were made overall, the findings supported informal clinical observations that children with reading impairments struggle more when reading verbs than nouns.

The current research sought to investigate word class differences in children's lexical retrieval and the relationship of these differences to reading ability in normal and impaired readers. It was expected that noun-versus-verb differences in reading and retrieval by normal and impaired readers would engender inferences about the influences of lexical access on reading comprehension. The present research was comprised of two experiments. The first experiment was aimed at devising sets of lexical stimuli for retrieval and reading of nouns and verbs. Efforts were made to incorporate important features described above into the design of stimuli. These sets of stimuli were employed in the second experiment to investigate the relationships between noun and verb reading and retrieval in normal and impaired readers.

The Hypotheses

Hypotheses 1 and 2 addressed the effects of reading impairment on accuracy of reading nouns and verbs. Noun vs. verb differences in single-word reading have been reported in patients with acquired alexia and aphasia (Marshall & Newcombe, 1966; Marshall & Newcombe, 1973).

Lexical class differences in single-word reading of age-appropriate reading material and persistence of noun-verb reading differences in the presence of contextual cues (i.e., in oral passage reading) have not been fully investigated.

Hypothesis 1: Reading Accuracy--Single-Word Reading

a. On a measure of single-word reading, impaired readers will exhibit less accurate reading of both nouns and verbs than normal readers.

b. Impaired readers will exhibit less accurate single-word reading of verbs than nouns.

Given evidence that reading impaired children depend more on contextual cues than normal readers (Nicholson, 1991), it was next sought to establish whether the pattern of relatively impaired verb reading persisted in the presence of contextual cues, i.e., during passage reading.

Hypothesis 2: Reading Accuracy--Oral Passage Reading

a. On a measure of oral passage reading, reading impaired subjects will exhibit less accuracy than normal readers when reading both nouns and verbs.

b. Impaired readers will exhibit more verb errors than noun errors on a test of oral passage

reading.

The third, fourth and fifth hypotheses were aimed at determining whether noun-verb differences in reading ability were paralleled by comparable deficits in word retrieval. The third hypothesis addressed the relationship between reading proficiency and lexical retrieval by comparing normal and impaired readers on measures of confrontation naming, i.e., the use of a pictured stimulus to elicit retrieval of a target name. Impairments in object naming have been found not only to correlate highly with the presence of reading disabilities (Felton, et al., 1987; German, 1984) but to predict later development of reading disabilities (Wolf, 1984; Wolf & Goodglass, 1986). No studies have compared performances of normal and reading impaired children on measures of action naming or examined noun-verb differences in naming in normal or reading impaired children. It might be assumed that if noun retrieval is impaired, verb retrieval is comparably affected. Yet, information from disparate sources suggests this may not necessarily be the case. Research with adults with acquired deficits suggests that reading and retrieval of nouns and verbs can be differentially affected by those deficits (Kohn, et al., 1989; Marshall & Newcombe, 1966; Marshall & Newcombe 1973). Differences in the semantic organization of nouns and verbs (e.g., Aaronson & Ferres,

1984), and in the order in which nouns and verbs are acquired in early childhood (Camarata & Schwartz, 1985; Clark, 1983; Nelson, 1982), suggest that verbs may be even more vulnerable than nouns to developmental language deficits such as those which contribute to reading disabilities.

Hypothesis 3: Lexical Retrieval--Confrontation Naming of Nouns and Verbs

a. On confrontation naming of pictures, impaired readers will exhibit less accurate retrieval of both noun names and verb names than normal readers.

b. In consideration of verbs' more complex semantic organization and the later acquisition of verbs than nouns, impaired readers will exhibit less accurate verb naming than noun naming.

If one assumes that differences in reading skill between normal and impaired readers are partially a function of delayed development in basic lexical retrieval skills, reading impaired children would be expected to function at a less mature level of lexical development than normal readers of the same age. Impaired readers would be expected to have more difficulty generating action names in response to items which demand use of a

developmentally mature word association strategy. Thus, reading impaired children would be expected to have greater difficulty when retrieving a target name than normally reading peers when it is necessary to invoke more mature, paradigmatic, i.e., similarity-based, associations in order to do so. The fourth hypothesis was aimed at obtaining empirical evidence to this effect.

Hypothesis 4: Lexical Retrieval--Action Naming

a. Intergroup Differences: Impaired readers will exhibit less accurate action naming than normal readers of the same age when required to generate and then select among viable alternatives. Specifically, impaired readers will exhibit less efficient use of direct-object cues than normal peers.

b. Intragroup Differences: Impaired readers will exhibit more accurate action naming on items which facilitate or narrow the selection of an appropriate action name from among viable alternatives, and less accurate action naming on items which require them to generate and then select among viable synonyms. Specifically, impaired readers will name actions more accurately when a similarly named object is pictured than when a customarily-associated direct object, or no "cues," are pictured.

Hypothesis 5 addressed word class differences in synonym retrieval. Noun and verb stimuli were designed to be of comparable familiarity, where familiarity was operationally defined by word frequency and ease of retrieval in another retrieval task. Unlike the confrontation naming task, noun and verb synonym generation stimuli were not matched for difficulty during pilot study. Thus, this task offered an opportunity to determine the effect of word class on word retrieval for normal as well as impaired readers. Moreover, unlike the confrontation naming tasks, nouns and verbs in the synonym generation task were comparably devoid of contextual cues, making it possible to limit potentially confounding effects of context on word retrieval.

Hypothesis 5: Lexical Retrieval--Synonym Generation

a. Based on the assumption that reading impaired children have less well developed paradigmatic association skills than normal readers, impaired readers will exhibit greater difficulty generating synonyms for both noun targets and verb targets than normal readers.

b. Based upon assumed differences in lexical organization between nouns and verbs, both normal and impaired readers will exhibit poorer synonym retrieval for verb targets than noun targets of

comparable "familiarity."

It is a central premise of this research that deficits in reading and word retrieval share a common etiological factor: difficulty accessing the mental lexicon. Receptive vocabulary skills were expected to estimate the efficiency and accuracy with which word meanings are accessed.

Hypothesis 6: Reading, Word Retrieval, and Receptive Vocabulary

a. The level of receptive vocabulary will be positively correlated with performances on reading and retrieval measures.

b. Relative to normal readers, impaired readers will exhibit less accurate receptive vocabulary for verbs than nouns.

c. For impaired readers, verb knowledge will be a more significant predictor of word retrieval than noun knowledge.

d. For impaired readers, verb knowledge and retrieval will better predict reading performance than noun knowledge and retrieval.

EXPERIMENT 1: DEVELOPMENT OF STIMULI
FOR READING AND RETRIEVAL OF VERBS AND NOUNS

The purpose of Experiment 1 was to devise sets of stimuli for retrieval and reading of nouns and verbs by children, aged 9 to 11 years. These sets of stimuli were to be subsequently used in Experiment 2 to examine: a) confrontation naming of verbs (action naming); b) confrontation naming of nouns (object naming); and c) synonym generation for noun and verb target words.

Method

Subjects

Subjects were 23 children (9 males, 14 females), aged 8 to 12 years, who met the following inclusion criteria: a) English was their primary language; and b) no current or previous classification as Reading or Speech/Language Disabled by the local Committee on Special Education (CSE). Subjects were volunteers who were referred by acquaintanceship procedure, i.e., by referral of friends and classmates, and who had informed parental consent. The stimuli were intended for use in Experiment 2 with 9- to 11-year-olds. However, to obtain information about relative item difficulty at different levels of development and to facilitate the computation of item validity, it was necessary to include in the Experiment 1 sample a small number of 8- and 12-year-old subjects, as well as subjects representing a wide range of ability at each age- or grade-level. Mean subject characteristics are detailed in Tables 1-1 and 1-2. Table 1-1 presents characteristics and performances of the full sample of 8- to 12-year-old subjects. Table 1-2 presents characteristics and performances of the subset of that sample between the ages of 9 and 11 years, the age range of subjects in Experiment 2.

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 Table 1-1

Subject Variables: Full Sample--Subjects Aged 8-12 (n=23)

	<u>Range</u>	<u>Mean</u>	<u>Std.Dev.</u>
Age in Months	96-155	124.9	16.7
Grade	2-7	4.6	1.4
PPVT-R Standard Score	70-133	108.8	16.5
Boston Naming Test Score	26-55	42.1	8.9
RCFM Raw Score	14-35	27.4	5.3
Action Naming Subset Score	15-32	24.2	5.0
Object Naming Subset Score	18-33	25.2	5.0

Note. Gender Distribution: 9 Males, 14 Females

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 Table 1-2

Subject Variables: Subset of Full Sample--
 Subjects Aged 9-11 (n=17)

	<u>Range</u>	<u>Mean</u>	<u>Std.Dev.</u>
Age in Months	108-140	124.2	9.4
Grade	3-6	4.6	.9
PPVT-R Standard Score	82-133	109.4	15.8
Boston Naming Test Score	26-55	42.2	8.1
RCFM Raw Score	17-35	28.5	4.3
Action Naming Subset Score	19-32	24.5	4.0
Object Naming Subset Score	18-33	25.1	4.7

Note. Gender Distribution: 8 Males, 9 Females.

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Materials

To develop sets of stimuli to achieve the above-stated objectives, test stimuli and materials were used in two ways: as item pools from which the most valid, age-appropriate stimuli were to be extracted for subsequent use and to estimate the validity of the selected stimuli. The following materials were used during Experiment 1:

Ferrara Action Naming Stimuli (Copyright 1991). These were a set of 67 original drawings depicting people performing specific actions, each which could be identified by a single, present progressive-form verb (e.g., "[is] fishing"). Verb referents ranged widely in frequency in Grade 3 through 5 literature (Carroll, et al., 1971). To permit more detailed analysis of action naming, the action naming task included subsets of items differing with respect to the presence or absence of specific "contextual cues." Specifically, there were four "cuing" conditions: a) the similarly-named object condition, characterized by the presence in each picture of an object with the same name as the root of the referent verb (e.g. "SWINGing"); b) the direct-object condition, characterized by the presence in the picture of a customarily-associated direct object (e.g. "climbing" [a ladder]); c) the "neither cue" condition, characterized by the absence of both conditions a and b (e.g., "crawling"); and d) the "both cues" condition, characterized by the

simultaneous presence of conditions a and b (e.g., "SAILing" [a boat]). Inclusion or exclusion in each of the "cuing" condition(s) was determined during pilot study on the basis of consensus in three independent adult raters' review of the original 67 drawings.

The action naming stimuli were black-and-white line drawings depicting people performing specific actions. Each drawing was centered on 8 1/2 by 11 inch white paper. Items were administered in approximate order of increasing difficulty, based on estimates derived from informal pilot studies with adults and children.

Subjects were instructed to "Give me one word that tells what the person in the picture is doing." If the subject named the agent, (e.g., "This is a conductor."), the examiner prompted with, "What is he/she doing?" If the subject responded with several words or described the activity rather than naming the action (e.g., "She is in a car."), the examiner prompted with "Give me one word that tells what the person is doing." If a subject corrected or changed his/her answer, the last response was the one accepted. No other prompts were given, and subjects were not informed of the correctness of their responses.

The Boston Naming Test (BNT) (Kaplan, Goodglass & Weintraub, 1978). This is a 60-item set of object naming stimuli depicting objects in isolation, each of which can be identified by a single noun. Noun referents ranged

approximately as widely as verb referents, with respect to word frequency in Grade 3 through 5 literature (Carroll, et al., 1971).

The Boston Naming Test is published as black and-white line drawings, each centered on a 6 1/4 by 6 1/4 inch page. To make the stimuli more comparable in size to the action naming stimuli, each stimulus was photostatically enlarged to 1.4 times its original size and centered on 8 1/2 by 11 inch white paper. BNT stimuli were administered in the standard order, an order generally presumed to increase in difficulty as the test progresses, although information addressing this ordering is not present in the manual. Subjects were instructed to "Tell me the name of the thing in this picture." If the subject responded with several words or described the object rather than naming it (e.g., "This is what you cut with."), the examiner prompted with "Give me one word for the name of the thing in this picture." If a subject corrected or changed his/her answer, the last response was the one accepted. No other prompts were given, and subjects were not informed of the correctness of their responses.

Peabody Picture Vocabulary Test - Revised (PPVT-R) (Dunn & Dunn, 1981). This is a measure of receptive vocabulary which is highly correlated with confrontation naming performance in normal children (Halperin, Healey,

Zeitchik, Ludman, & Weinstein, 1989). PPVT-R scores have not been found to differ significantly between normal and reading disabled children (Felton, et al., 1987; German, 1984; Wolf, 1984; Wolf & Goodglass, 1986). Although correlational data is available only for the previous edition of the PPVT (Dunn & Dunn, 1981), the PPVT-R is frequently presumed to correlate positively with level of intelligence. In the current study, the PPVT-R was used to estimate subjects' level of general cognitive functioning. In addition, as intelligence and vocabulary are among the abilities and aptitudes presumed to underlie expressive naming, PPVT-R scores were used to estimate the construct validity of the subsets of action and object naming stimuli selected for use in Experiment 2. The PPVT-R was administered in accordance with standard instructions.

Raven Coloured Progressive Matrices (RCPM) (Raven, 1965). This test of non-verbal reasoning was used in this study primarily to facilitate change of set between action and object naming stimuli. As this measure is sometimes considered a non-verbal estimate of cognitive functioning (Raven & Summers, 1990), RCPM score was expected to be correlated not only with PPVT-R standard score, but with performances on the subsets of action and object naming stimuli selected for use in Experiment 2. The relationship between the RCPM performance and naming could provide further evidence of the construct validity of the action

and object naming stimuli. The RCPM was administered according to standard instructions.

Synonym Generation Stimuli: This prototypal synonym generation task was comprised of 10 noun and 10 verb targets (Nouns: CANOE, ABACUS, PELICAN, TRIPOD TRELIS, LATCH, IGLOO, ACORN, NOOSE, BENCH; Verbs: WASHING, SEARCHING, CARVING, SIGNALING, COMPOSING, DEMONSTRATING, IRONING, HAMMERING, CONDUCTING, MASSAGING). These stimuli were administered to the last five Experiment 1 subjects to ensure that instructions were clear and that the target words were familiar to children this age.

A tentative list of 28 potential noun and verb targets was compiled from target words which had elicited synonyms and from plausible synonym responses given during administration of the confrontation naming tasks to the first 18 subjects. From that pool of possible targets, items were eliminated if they: a) were not subjectively judged by three adult raters to elicit synonyms "easily"; or b) did not elicit synonyms with which 9- to 11-year-old children should be familiar, i.e., words that are encountered in grade appropriate reading material (Carroll, et al., 1971). Comparable "familiarity" of noun and verb targets was sought by matching items in each word class for word frequency in Grade 3-5 literature (Carroll, et al., 1971) and "retrieval ease," operationally defined by the number of Experiment 1

subjects who had spontaneously produced the target word during confrontation naming. No attempt was made to match items for synonym generation difficulty, as it was intended that the synonym generation instrument, when used in Experiment 2, would elicit any relative verb vs. noun retrieval difficulties which might exist between sets of words of comparable familiarity.

The 10 nouns and 10 verbs were printed in double-height, double-width Sans Serif type, one word per 8 1/2 by 11 inch page. The nouns and verbs were presented separately by word class, with each word-class list preceded by administration of two high-frequency non-scored examples to assist subjects in establishing and maintaining set. The task was introduced by printed and orally-presented instructions: "I am going to show you some words, one at a time. I want you to tell me a word that means the same thing as the word I show you." To eliminate confounding effects of reading level, each target was read aloud by the examiner, accompanied by the written target word: "This word is "----." Tell me another word that means the same thing as "----."" If a subject did not respond to an item within 10 seconds, the examiner rephrased the instructions: "What's another word for "----"?" No other prompts were given, and subjects were not informed of the correctness of their responses.

Procedure

All 23 subjects were administered four tasks in the following order: a) the action naming stimuli, b) Raven Coloured Progressive Matrices, c) the Boston Naming Test, and d) the Peabody Picture Vocabulary Test - Revised. The last five subjects were administered, in addition, the synonym generation task comprised of 10 nouns and 10 verbs. All tasks were individually administered in a single session, each approximately 45 to 60 minutes in duration.

Results

Selection of stimuli to evaluate word class differences in confrontation naming, synonym generation, reading, and receptive vocabulary entailed analyzing the data from 8- to 12-year-old subjects. The results of those analyses, and descriptions of the stimuli which were derived from them, are presented here.

Confrontation Naming Stimuli

Item Selection

Data from the original sets of 67 action naming and 60 object naming (i.e., Boston Naming Test) stimuli were separately subjected to the following statistical analyses: a) calculation of an item discrimination index (Flanagan's \underline{r}), i.e., a measure of item validity representing the success with which each item discriminated between the 27% highest and 27% lowest scorers, such that high scorers passed and low scorers failed the item; b) calculation of each item's level of difficulty, estimated by the proportion of subjects passing the item; and c) identification of word frequency, i.e., frequency of occurrence in a corpus of Grade 3-5 literature (Carroll, et al., 1971). Based on these computations and subjective review of subjects' responses

to the stimuli, items were eliminated if they were: a) ambiguous (i.e., misperceived or elicited several conflicting but equally appropriate names); b) too difficult for children of the designated age (based upon failure of 20 or more of the 23 subjects to answer correctly); and c) of low validity (i.e., poorly discriminating items on which low scorers did relatively well or high scorers did relatively poorly).

Action Naming Stimuli and Cuing Conditions

From the pool of 59 remaining action naming stimuli, action naming stimuli were further selected to include seven items from each of the four previously described "cuing" conditions: similarly-named object present, direct object present, "neither cue" present, and "both cues" present. Those four subsets of action naming items were matched as closely as possible with respect to a) word frequency, i.e., frequency of occurrence in a corpus of Grade 3-5 literature (Carroll, et al., 1971); b) level of difficulty, estimated by the proportion of subjects passing the item; and c) item discrimination index (Flanagan's \underline{r}) (Table 1-3). Separate analyses of variance, in which cuing condition was the independent variable and frequency, difficulty and discrimination index were the respective dependent variables, revealed that the four sets of stimuli did not differ significantly with respect

to either word frequency ($F < 1$), difficulty ($F < 1$), or discrimination index ($F < 1$) (Table 1-3). These findings suggested that the sets of items in the four cuing conditions were comparable in terms of the three measures. The item selection process resulted in a stimulus set of 35 action naming items, 28 of which were assigned to one of the four cuing conditions, and an additional four items, which had been correctly answered by all subjects, intended for use as "warm-up" or practice stimuli in Experiment 2 (Appendix A).

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Table 1-3

Action Naming Stimuli: Word Frequency, Difficulty, and Discrimination Index by Cuing Condition

	Mean Scores (Std. Dev.)		
	Word Freq. ¹	Difficulty ²	Discrim. Index ³
Both Cues	21.29 (40.60)	17.00 (6.43)	0.36 (0.39)
Similar Object	19.00 (27.72)	16.57 (6.27)	0.41 (0.32)
Direct Object	21.86 (20.75)	16.29 (7.39)	0.40 (0.39)
Neither Cue	19.71 (22.81)	16.71 (8.12)	0.45 (0.33)

¹ Word Frequency: Frequency of Occurrence in Corpus of Grade 3-5 Literature studied by Carroll, Davies & Richman, 1971.

² Difficulty: Item Difficulty based upon number of Experiment 1 subjects (of N=23) who answered item correctly.

³ Discrimination Index: Flanagan's \underline{r} , representing ability of item to discriminate between high and low scorers such that high scorers passed item and low scorers failed item.

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Object Naming Stimuli

Stimuli from the BNT were subjected to the same initial selection criteria as the action naming stimuli,

viz., a) item discrimination index (Flanagan's d); b) level of difficulty estimated by the proportion of subjects passing the item; and c) word frequency, i.e., frequency of occurrence in a corpus of Grade 3-5 literature (Carroll, et al., 1971). Items were matched as closely as possible with the action naming stimuli with respect to frequency, difficulty, and discrimination index. The item selection process resulted in a stimulus set of 35 object naming stimuli and an additional four items, which had been correctly answered by all subjects, intended for use as "warm-up" or practice stimuli in Experiment 2 (Appendix B). Mean, standard deviation, and range of each of the selection variables are presented in Table 1-4. To determine the comparability of the sets of action and object naming stimuli (Table 1-4), the two 35-item sets of confrontation naming stimuli were submitted to analysis of variance, with type of stimulus (action vs. object) as the independent (between groups) variable, and item frequency, difficulty, and discrimination index as the respective within groups variables. The two sets of stimuli did not differ significantly with respect to either word frequency ($F < 1$), difficulty ($F < 1$), or discrimination index ($F < 1$), suggesting that items in the two subsets of stimuli were comparable in terms of each of the three measures.

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Table 1-4

Confrontation Naming Stimuli: Word Frequency, Difficulty,
And Discrimination Index by Word Class

	<u>Object Naming Stimuli</u>		
	<u>Range</u>	<u>Mean</u>	<u>Std.Dev.</u>
Word Frequency ¹	0-162	25.54	34.42
Difficulty ²	3-23	16.51	7.37
Discrimination Index ³	.0-.93	.47	.36

	<u>Action Naming Stimuli</u>		
	<u>Range</u>	<u>Mean</u>	<u>Std.Dev.</u>
Word Frequency ¹	0-154	23.57	36.14
Difficulty ²	3-23	16.17	6.92
Discrimination Index ³	.0-.85	.47	.35

¹ Word Frequency: Frequency of Occurrence in Corpus of Grade 3-5 Literature studied by Carroll, Davies & Richman, 1971.

² Difficulty: Item Difficulty based upon number of Experiment 1 subjects (of N=23) who answered item correctly.

³ Discrimination Index: Flanagan's r , representing ability of item to discriminate between high and low scorers such that high scorers passed item and low scorers failed item.

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Reliability

The reliability of an assessment device represents the extent to which scores on that device "are free from errors of measurement" (American Psychological Association, 1985, p. 19). Reliability for each set of confrontation naming stimuli was estimated from the internal consistency of the stimulus sets by Kuder-Richardson Formula 20 (Thorndike, 1982, p. 176-177). That formula compares the relative accuracy with which subjects answered each item with the variance of the task as a whole. The resulting reliability coefficient is equivalent

to Cronbach's coefficient alpha for sets of items which are homogeneous in content and are scored either "1" or "0." The reliability coefficient based on Experiment 1 data for the set of action naming stimuli ($r=.85$) and for the set of object naming stimuli ($r=.88$) suggest comparable and acceptable levels of internal consistency.

Validity

Construct validity refers to the ability of a measure or set of stimuli to assess those latent aptitudes or abilities which hypothetically underlie the measure (American Psychological Association, 1985; Anastasi, 1982; Thorndike, 1982). Correlations between the set of stimuli "under study and other measures believed to reflect or depend upon the attribute in question" constitute one source of evidence of construct validity (Thorndike, 1982, p. 186). In the case of confrontation naming measures, construct validity could be estimated by the extent to which scores on confrontation naming stimuli are correlated with such aptitudes or abilities as vocabulary, general intelligence, and other naming skills. To evaluate the validity of the 35-item action and object naming subtests as measures of confrontation naming, Pearson correlations were examined between performances on the subsets of action naming (FANSUB) and object naming (BNTSUB) stimuli and other tests which presumably had a

conceptual or theoretical relationship to confrontation naming. Specifically, action and object naming scores were compared with scores representing: a) receptive vocabulary, i.e., PPVT-R raw score (PPVRAW); b) level of cognitive functioning, i.e., age-corrected PPVT-R Standard Scores (PPVSTD); and c) non-verbal reasoning, i.e., raw score on the Raven Coloured Matrices (RVNRAW). In addition, to cross-validate the stimulus subsets as measures of confrontation naming, performances on the action naming subset (FANSUB) were compared with the full BNT score (BNTTOT), and scores on the object naming subset (BNTSUB) were compared with scores on the full set of action naming stimuli (FANTOT). All correlations are presented in Table 1-5.

Both the action naming and object naming subsets of stimuli correlated positively and significantly with the PPVT-R Raw Score, PPVT-R Standard Score, and Raven Coloured Progressive Matrices Raw Score (Table 1-5). These positive correlations between both confrontation naming stimulus subsets and vocabulary, general intelligence and non-verbal reasoning constituted indirect evidence of the construct validity of the confrontation naming stimuli. The action naming scores were less strongly correlated than object naming scores with PPVT-R performances because, most likely, verbs comprise a smaller percentage of PPVT-R items than concrete nouns. Further evidence of

construct validity was suggested by the significant correlation between the two 35-item naming subsets, FANSUB and BNTSUB, themselves, and between each stimulus subset and the full set of confrontation naming stimuli for the alternate word class.

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Table 1-5

Confrontation Naming Stimuli: Pearson Correlations^a
Among Measures (N=23)

	<u>FANSUB</u> ¹	<u>BNTSUB</u>	<u>PPVRAW</u>	<u>PPVSTD</u>	<u>RAVENS</u>	<u>FANTOT</u>	<u>BNTTOT</u>	<u>AGEYRS</u>	<u>GRADE</u>	<u>GENDER</u>
FANSUB	1.00	.82**	.77**	.55**	.65**	--	.82**	.46*	.44*	-.33
BNTSUB	--	1.00	.83**	.67**	.70**	.83**	--	.44*	.39	-.35
PPVRAW	--	--	1.00	.82**	.67**	.73**	.86**	.46*	.41*	-.29
PPVSTD	--	--	--	1.00	.61**	.48*	.74**	-.11	-.16	-.19
RAVENS	--	--	--	--	1.00	.67**	.76**	.16	.15	-.30
FANTOT	--	--	--	--	--	1.00	.82**	.49*	.46*	-.43*
BNTTOT	--	--	--	--	--	--	1.00	.37	.31	-.32
AGEYRS	--	--	--	--	--	--	--	1.00	.92**	-.28
GRADE	--	--	--	--	--	--	--	--	1.00	-.16
GENDER	--	--	--	--	--	--	--	--	--	1.00

¹ Abbreviations:

FANSUB=score on 35-item subset of Ferrara Action Naming Stimuli

BNTSUB=score on 35-item subset of Boston Naming Test Stimuli

PPVRAW=PPVT-R raw score

PPVSTD=PPVT-R Standard Score

RAVENS=Raven Coloured Progressive Matrices Raw Score

FANTOT=score on full 67-item set Ferrara Action Naming Stimuli

BNTTOT=full 60-item Boston Naming Test Score

^a All Correlations are Pearson Product Moment Correlations except those related to Gender which are point biserial correlations, a special case of the Pearson Correlation used when one variable is dichotomous.

Pearson/Point Biserial Correlations (2-tailed):

* = p<.05; ** = p<.01

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Both action and object naming scores were significantly

positively correlated with age, and action naming scores were correlated positively with grade, suggesting that naming performance improved with age. This is consistent with expectations that naming ability should improve as vocabulary and linguistic facility develop. Age and grade correlations with the action and object naming subsets may be higher with broader age and grade ranges. The absence of significant correlations between either subset of naming stimuli and gender suggests the absence of gender bias. In general, these findings suggested that the 35-item subsets of action and object naming stimuli constituted valid tasks for measurement of confrontation naming and were suitable for use with children within the target age range.

To help establish the expected pattern of responding (i.e., noun or verb retrieval) for use in Experiment 2, the selected action and object naming stimuli were reordered as follows. Each set of confrontation naming stimuli was prefaced by four sample items, high frequency targets which all Experiment 1 subjects had named correctly. The remaining 35 items in each set of stimuli were arranged in alternating level of difficulty so that each relatively difficult item was followed by a relatively easy item. This order was adopted to elicit optimal attention to and interest in the tasks, regardless

of a subject's level of competence.

Synonym Generation

The 20-item (10 noun, 10 verb) synonym generation task, which was derived from the confrontation naming responses of the first 18 subjects, was administered to the last five subjects to ensure that instructions were clear. On the basis of this pilot administration, four matched pairs of items were eliminated from the task because one member of a pair either: a) elicited a verb synonym when a noun was expected ("bench" elicited "retire"); b) elicited primarily non-words and two-word responses as synonyms ("ironing" elicited "not wrinkling" and "dewrinkling"); or c) was unfamiliar to three or more of the subjects ("trellis" and "noose"). A final list of six nouns and six verbs of comparable "familiarity" was derived from the original item pool (Appendix D). Familiarity was defined as the word frequency and retrieval ease of noun and verb targets, the range, mean and standard deviation of which are shown in Table 1-6.

Separate analyses of variance were performed, with target word class (noun vs verb) as the independent (between-groups) measure and word frequency and retrieval ease as the dependent variables (Table 1-6). The two sets of stimuli did not differ significantly with respect to either word frequency ($F < 1$), or the number of subjects who

had spontaneously selected the target word during the naming task ("retrieval ease": $F < 1$), suggesting the items in the two subsets of stimuli were comparable in terms of their "familiarity" to the Experiment 1 subjects. All five Experiment 1 subjects exhibited no difficulty comprehending the task expectations.

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Table 1-6

Synonym Generation Stimuli: Familiarity (Word Frequency And Retrieval Ease) by Word Class (N=18)

		<u>Noun Targets</u>	
	<u>Range</u>	<u>Mean</u>	<u>Std.Dev.</u>
Word Frequency ¹	3-66	16.83	24.35
Retrieval Ease ²	0-18	11.67	7.61
		<u>Verb Targets</u>	
	<u>Range</u>	<u>Mean</u>	<u>Std.Dev.</u>
Word Frequency ¹	0-69	16.50	26.03
Retrieval Ease ²	0-19	12.00	7.07

¹ Word Frequency: Frequency in Corpus of Grade 3-5 Literature reviewed by Carroll, et al., 1971.

² Retrieval Ease: Number of Subjects (Max N=23) who spontaneously retrieved target word during Confrontation Naming tasks.

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Discussion

Experiment 1 resulted in the development of sets of stimuli for retrieval and reading of nouns and verbs for use with children aged 9 to 11 years, during Experiment 2.

Confrontation Naming of Actions and Objects

Subsets of drawings of objects and of people performing actions were selected from larger pools of items to comprise sets of action and object naming stimuli matched for word frequency, item difficulty, and ability to discriminate between high and low scorers on each task as a whole. These stimulus subsets each represented a 35-item confrontation naming task, which was intended for administration to 9- to 11-year-old normal and impaired readers during Experiment 2 of the current research. The action and object naming stimuli were intentionally selected to be of comparable difficulty, based on performance of the present sample of normal children. The tasks were designed, therefore, to reveal differences between normal and reading impaired children in Experiment 2, but not to disclose within-group (noun vs. verb) differences among the normal subjects themselves.

Synonym Generation

To contribute information about the relative

difficulty of noun and verb retrieval for normal and impaired readers, a synonym generation task was devised. That task was comprised of six noun and six verb items which were matched on characteristics which would presumably contribute to their "familiarity" to 9- to 11-year-old children, i.e., word frequency in Grade 3-5 literature, and the frequency with which those words were spontaneously retrieved during administration of the confrontation naming tasks ("retrieval ease"). Unlike the confrontation naming tasks, the noun and verb synonym generation subsets were not matched with respect to level of difficulty because the task was to be used to explore this aspect of noun and verb retrieval during Experiment 2. In contrast with confrontation naming stimuli in which action naming pictures appeared to afford greater contextual information than object naming pictures, the absence of contextual cues in the synonym generation task was expected to rule out the potentially confounding influence of context on word class retrieval.

EXPERIMENT 2: NOUN AND VERB READING AND RETRIEVAL
IN IMPAIRED AND NORMAL READERS

The purpose of Experiment 2 was to explicate the interrelationships among expressive and receptive language skills and reading impairments, by investigating word class differences in reading ability and lexical retrieval in normal and reading impaired children. Differential patterns in reading and word retrieval by word class and reading group were expected to contribute to inferences about the influence of lexical access on reading comprehension.

Method

Subjects

Impaired Reader Group

The sample of impaired readers was comprised of 20 children (13 males, 7 females) who had been classified as "Learning Disabled" by the local CSE in an upstate NY public school district. Additional inclusion criteria were: a) IQ was 85 or above; b) English was the primary language; c) age was between 9 and 11 years at the time of testing; d) reading level was a minimum of one and one-half years below chronological age. Exclusion criterion was identification by the CSE as Emotionally Disturbed or Mentally Retarded.

Normal Reader Group

The sample of 20 normal readers (10 males, 10 females) consisted of 3rd, 4th, and 5th grade students aged 9 through 11 years, who met the following inclusion criteria: a) English was the primary language; and b) neither current nor previous classification as Reading Disabled, Speech/Language Disabled, Emotionally Disturbed, or Mentally Retarded by the local CSE.

Recruitment Of Subjects and Confidentiality

Subjects were recruited from elementary and middle schools in two suburban public school systems in upstate New York. Letters describing the study and consent forms were distributed to parents of all learning disabled 9- to 11-year-old students who met previously described criteria, and to parents of a subset of mainstream 9- to 11-year-old students preselected by school personnel to represent an academically varied cross-section of 3rd, 4th, and 5th graders. All subjects had informed, written parental consent. Each subject's confidentiality was protected. The subject's name did not appear on any interview or response forms; instead, each form was coded with a number.

Materials

Six tasks were administered to assess word retrieval, receptive word knowledge, and oral reading skill. One task was included to facilitate the transition from action to object naming. Those tasks were:

Reading Tasks

Gray Oral Reading Tests-Revised, Form A (GORT-R; Wiederholt & Bryant, 1986): an oral passage reading test. The GORT-R provided scores for reading rate/accuracy and

comprehension.

Single Word Reading Task: a single-word reading (word recognition) task sensitive to lexical class and suitable for children of this age group. Lists of all nouns and verbs which were unambiguous as to word class when taken out of context were extracted from the Gray Oral Reading Tests - Revised (Form A, all passages). From that pool of potential single word reading stimuli, comparable subsets of 31 nouns and 31 verbs (Appendix E) were selected on the basis of similarity with respect to number of syllables [ANOVA: $F(1,60) < 1$] and word frequency in a corpus of third to fifth grade literature (Carroll, et al., 1971) [ANOVA: $F(1,60) < 1$] (Table 2-1).

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Table 2-1

Comparison of Noun and Verb Stimuli Extracted From The GORT-R:
Word Frequency and Number of Syllables by Word Class

	<u>Verbs</u> (31 words)		
	<u>Range</u>	<u>Mean</u>	<u>Std.Dev.</u>
Word Frequency ¹	2-1276	204.1	297.6
Syllables	1-3	1.8	.7
	<u>Nouns</u> (31 words)		
	<u>Range</u>	<u>Mean</u>	<u>Std.Dev.</u>
Word Frequency ¹	1-1353	208.9	316.7
Syllables	1-3	1.8	.7

¹ Word Frequency: Frequency of occurrence in corpus of Grade 3-5 Literature (Carroll, et al., 1971)

=====

Frequency and number of syllables were presumed to be associated with word "familiarity" and indirectly related to level of reading difficulty. No attempt was made to control the actual difficulty of the words, because both between- and within-group comparisons of reading accuracy by word class were planned. Five to seven words were printed in double-height, double-width Sans Serif type on each page. Items were ordered by word frequency count and were, thus, randomized with respect to word class order. Subjects were instructed to read each word aloud at whatever speed was comfortable for them.

Contextual Reading of Nouns and Verbs. To provide a measure of noun and verb reading within the context of a reading passage, the same nouns and verbs that comprised the single word reading task (Appendix E) were identified within the context of the GORT-R passages.

Lexical Retrieval Tasks

Confrontation Naming of Actions: the 39-item set of action naming stimuli, comprised of four introductory and 35 scored items, determined from Experiment 1 (Appendix A). The action naming task included four subsets of seven stimuli each, matched for word-frequency and item difficulty, differing by "cuing" content, as follows: a) similarly-named object present in the picture; b) customarily-associated direct object present in the

picture; c) both "cues" present in the picture; d) neither "cue" present in the picture. Representative items from each category are presented in Appendix C.

Confrontation Naming of Objects: the 39-item set of object naming stimuli, comprised of 4 introductory and 35 scored items, extracted from the Boston Naming Test (Kaplan, et al., 1978), determined from Experiment 1 (Appendix B).

Synonym Generation to Noun and Verb Targets: the 12-item synonym generation task determined from Experiment 1 (Appendix D).

Receptive Vocabulary Task

Peabody Picture Vocabulary Test - Revised (PPVT-R; Dunn & Dunn, 1981): a receptive vocabulary test from which three scores were computed: a) PPVT-R Standard Score; b) PPVT-R Noun Score (proportion of unambiguous noun items answered correctly between initial item and ceiling item); and c) PPVT-R Verb Score (proportion of unambiguous verb items answered correctly between initial item and ceiling item).

A Form-Copying Task

The Rosen Drawing Test (Rosen, 1980): a task which entails copying of geometric forms of increasing

complexity.

Procedure

All subjects were administered the tasks in the following order: a) the set of action naming stimuli; b) The Rosen Drawing Test; c) the set of object naming stimuli; d) Gray Oral Reading Tests - Revised, Form A (GORT-R); e) the synonym generation task; f) the 62-item single-word reading list; and g) the Peabody Picture Vocabulary Test - Revised (PPVT-R). The GORT-R and PPVT-R were administered according to standardized procedures. The GORT-R and single-word reading list were administered in alternating order to reduce confounding by prior exposure to the target words. The noun and verb stimulus sets of the synonym generation task were administered in counterbalanced order to control for any confounding effects which might result from subjects' consistent exposure to one word class before the other. Subjects in each group were numbered consecutively. Odd-numbered subjects were administered the single-word reading list followed by the the noun-set of synonym generation stimuli, the verb-set of synonym stimuli and the GORT-R passage reading test. Even-numbered subjects were administered the GORT-R passage reading test followed by the the verb-set of synonym generation stimuli, the noun-set of synonym stimuli and the single-word reading list.

The PPVT-R was administered to all normal and reading disabled subjects not only as an estimate of receptive vocabulary, but also as an estimate of general cognitive functioning which could be introduced as a covariate, if the groups did not perform comparably on the PPVT-R. The Rosen Drawing Test was administered to facilitate the change of set between action and object naming.

All tasks were individually administered by the author, each in a single session approximately 45 to 60 minutes in duration. Subjects' oral responses were recorded verbatim, in writing, by the author.

Results

Subjects

Demographic characteristics of the Impaired Readers (IR) and Normal Readers (NR) are shown in Table 2-2.

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Table 2-2

Demographic Characteristics, Reading Scores, and PPVT-R Scores For Each Group

	<u>Normal Readers</u> (N=20)	<u>Impaired Readers</u> (N=20)
Mean Age in Years ^{NS}	10.3 (0.9) ¹	10.2 (0.9)
Mean Grade ^{NS}	4.0 (1.0)	3.7 (0.7)
Gender ^{NS}		
Number Male	10	13
Number Female	10	7
Handedness ^{NS}		
Number Right	18	17
Number Left	2	3
GORT-R Quotient ^{***}	106.9 (15.2)	79.5 (15.6)
Comprehension ^{2***}	105.5 (13.4)	87.8 (11.8)
Passage ^{2***}	106.0 (13.5)	78.0 (15.7)
Single Word Rdg. ^{3***}	91.4% (9.5%)	51.8% (24.3%)
PPVT-R Score ^{***}	115.5 (13.4)	94.5 (10.1)

¹ Means are presented with Standard Deviations in parentheses

² Comprehension and Passage Standard Scores converted to Scale where X=100, SD=15

³ Single Word Reading Score = Percentage of nouns and verbs read correctly

Between Group Differences: ANOVA / Chi²

NS = not significant (p>.05)

*** = p<.001

=====

The groups did not differ significantly in age [$F(1,38) < 1$], grade [$F(1,38) < 1$], gender distribution [$\chi^2(df=1) = .92, p > .05$], or handedness [$\chi^2(df=1) = .23, p > .05$]. All subjects tolerated the tasks and duration of the session without evidence of fatigue or frustration. Moreover, impaired readers appeared to comprehend task instructions as well as the normal readers.

Reading Variables

Several measures of reading skills were analyzed to determine whether the samples differed in the predicted direction, i.e., that normal readers performed better than impaired readers. Reading comprehension was estimated by the Comprehension Score on the GORT-R. Overall reading accuracy was estimated by two scores: Passage Score on the GORT-R, a score derived from passage reading accuracy and speed, and by proportion correct on the 62-item single word reading list (word recognition).

Results of individual analyses of variance (ANOVA) confirmed that the reading performances of IR and NR samples differed in the expected direction. As shown in Table 2-2, the NR group had significantly higher GORT-R scores than did IR (GORT-R Reading Quotient: $F(1,38) = 31.6, p < .0001$; GORT-R Comprehension: $F(1,38) = 19.9, p < .0001$; GORT-R Passage: $F(1,38) = 36.6, p < .0001$). Normal readers also performed significantly better than impaired readers

with respect to accuracy in single word reading [F(1,38)=46.3, p<.0001].

Pearson correlations computed separately for each group revealed that GORT-R Comprehension and Passage scores were significantly positively correlated in each group [NR: $r=.77$, $df=18$, $p<.01$; IR: $r=.85$, $df=18$, $p<.01$] (Table 2-3).

=====
Table 2-3

Pearson Correlations Among Reading Measures

	<u>Normal Readers (N=20)</u>		
	<u>GORT-R Comp.</u>	<u>GORT-R Pssq.</u>	<u>Single-Wd.Rdg.</u>
GORT-R Comprehension	1.0		
GORT-R Passage	.77**	1.0	
Single Word Reading ¹	.23 ^{NS}	.50*	1.0

	<u>Impaired Readers (N=20)</u>		
	<u>GORT-R Comp.</u>	<u>GORT-R Pssq.</u>	<u>Single-Wd.Rdg.</u>
GORT-R Comprehension	1.0		
GORT-R Passage	.85**	1.0	
Single Word Reading ¹	.58**	.83**	1.0

¹ Single word reading score = mean proportion of nouns and verbs read correctly

Pearson Correlations

NS = not significant ($p>.05$)

* = $p<.05$ (2-tailed)

** = $p<.01$ (2-tailed)

=====
To further study the relationship between reading comprehension and accuracy, GORT-R Comprehension and

Passage scores were analyzed via split-plot design (SPF-2.2) with repeated measures analysis of variance (MANOVA). As expected, the MANOVA revealed a significant main effect for group [$F(1,38) = 31.4$; $p < .0001$]; normal readers performed better than impaired readers with respect to both GORT-R Comprehension and Passage Scores. A significant main effect was also obtained for type of test [$F(1,38) = 11.0$; $p < .01$]. However, a significant group-by-test interaction [$F(1,38) = 13.4$; $p < .0001$] was found in which the Reading Impaired group had higher Comprehension than Passage (accuracy) scores, while the normal readers were equally proficient on both measures (Table 2-4).

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Table 2-4

GORT-R Comprehension and Passage Scores For Each Group

	Mean Standard Scores ¹ (Std.Dev.)	
	<u>GORT-R Comprehension</u>	<u>GORT-R Passage</u>
Normal Readers (N=20)	105.50 (13.36)	106.00 (13.53)
Impaired Readers (N=20)	87.75 (11.75)	78.00 (15.68)

¹ Standard Scores with Mean=100, SD=15

=====
Pearson correlations between single word reading (word recognition) and Gray Oral Comprehension and Accuracy scores revealed a stronger positive relationship between

those scores for impaired than for normal readers (Table 2-3). Among impaired readers, inaccuracies were relatively pervasive in the portion of the single word reading list which overlapped with words in the GORT-R passages they read and, as such, could not avoid weakening comprehension.

Overall, these findings indicated that the groups differed in the predicted direction on the critical factors of reading comprehension and accuracy, but did not differ with respect to several subject variables which might have confounded results, including age, grade, gender and handedness.

Receptive Vocabulary

It had been anticipated that the impaired readers would be characterized by weaker receptive vocabulary skills than normal readers, estimated by between-group differences in mean Peabody Picture Vocabulary Test - Revised (PPVT-R; Dunn & Dunn, 1981) scores. This expectation was confirmed as the standard scores were significantly lower for the IR group than for the NR group [$F(1,38)=31.6, p<.0001$] (Table 2-2).

Because the PPVT-R is frequently assumed to estimate general level of cognitive functioning, so large a PPVT-R discrepancy between groups raises important concerns about the comparability of the groups' levels of general

intelligence. Two factors were of importance in this regard: a) that the IR group was of grossly normal intelligence and could, therefore, be assumed a representative group of reading impaired children; and b) that the level of cognitive functioning of the NR group did not so greatly outweigh that of the IR group that between group comparisons would be rendered meaningless.

To draw conclusions with respect to the cognitive functioning Wechsler Intelligence Scale for Children - Revised (WISC-R) scores were obtained for as many children in the IR group as possible. WISC-R scores were available for 12 IR children; in three cases, another measure of general cognitive functioning had been administered in lieu of the WISC-R; in five other cases, the parents refused to release WISC-R scores.

Mean IQ, PPVT-R and reading scores are presented for the subset of 12 impaired readers for whom WISC-R scores were available (Table 2-5). PPVT-R scores were significantly positively correlated with Full Scale IQ ($r=.62$) and Verbal IQ ($r=.65$). t-tests for related data failed to suggest significant differences between the mean scores [PPVT-R with FSIQ, $t(11) < 1$] [PPVT-R with VIQ, $t(11) < 1$]. Although the correlation between PPVT-R and Performance IQ scores was not statistically significant ($r=.51$; $p>.05$), no significant difference was found between mean PPVT-R and PIQ scores [$t(11) = -1.58$; $p>.05$].

Mean PIQ score (99.8), which is presumably the WISC-R score least biased in the presence of underlying language dysfunction, was comparable to mean score of the WISC-R standardization sample (100). Thus, available IQ scores for the impaired readers suggested that these children were grossly within normal limits in terms of general cognitive functioning.

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Table 2-5

Mean Scores¹ Of A Subset Of Impaired Readers
For Whom IQ Scores Were Available (N=12)

<u>Test/Subtest</u>	<u>Mean Score</u>
Mean WISC-R FSIQ	97.3 (SD=10.5)
Mean WISC-R VIQ	96.3 (SD=8.8)
Mean WISC-R PIQ	99.8 (SD=11.7)
Mean PPVT-R	95.1 (SD=7.7)
Mean GORT-R Comprehension	88.8 (SD=11.3)
Mean GORT-R Passage	76.7 (SD=15.6)

¹ All Scores are presented in Standard Score Units with Mean=100 and Std.Dev.=15

=====
Significant differences between level of cognitive functioning and reading performance were evident within the IR subset which further supported the identity of the group as reading impaired. Specifically, standardized GORT-R Comprehension (\bar{x} =88.8) and Passage (\bar{x} =76.7) scores

were significantly lower than mean FSIQ (97.3), PIQ (99.8), and VIQ (96.3) scores (Table 2-6).

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Table 2-6

Differences Between Mean Scores For Reading and IQ Measures: Results of Single t-Tests (2-tailed) For Related Data, For Subset of Impaired Readers¹

<u>Test/Subtest</u>	<u>t-Test Results</u>	
	<u>GORT-R Comprehension</u>	<u>GORT-R Passage</u>
WISC-R FSIQ	2.71*	6.06***
WISC-R VIQ	2.44*	5.53***
WISC-R PIQ	3.18**	6.18***
PPVT-R	2.69*	5.51***

¹ Subset of 12 Impaired Readers For Whom IQ Data Were Available

* = p<.05 (2-tailed;df=11)

** = p<.01 (2-tailed;df=11)

*** = p<.001 (2-tailed;df=11)

=====

It was more difficult to confirm comparability of the groups. No IQ scores were available for the normal readers, as children in mainstream classes in public schools are not customarily administered individual intelligence tests. Given the fact that 11 of the 20 children in the group of normal readers had PPVT-R scores that were greater than one standard deviation above the test mean, i.e., above 115, the possibility that that sample is "supranormal" could not be ruled out. It may

have been the case, for example, that a larger than expected proportion of relatively high functioning normal readers volunteered to participate, perhaps because of their or their parents' greater enthusiasm for the challenge of an academically oriented project, or because they were less apt to fear embarrassment in such a project than lower functioning peers.

Re-examination of Reading Scores with PPVT-R As Covariate

To control for variations in estimated level of intelligence, reading scores were re-examined by individual analysis of covariance (ANCOVA), with PPVT-R score introduced as covariate. On the basis of this analysis, between-group differences in single word reading (word recognition) remained statistically significant [$F(1,37)=13.6, p<.001$]. Differences in oral passage reading accuracy, estimated by GORT-R Passage Scores, also remained statistically significant [$F(1,37)=5.6, p<.05$]. Thus, the between-group differences in reading accuracy persisted, even when scores were controlled for the influence of receptive vocabulary.

In contrast, previously significant between-group differences in oral reading comprehension were not maintained when GORT-R Comprehension Scores were controlled for PPVT-R score [$F(1,37)=1.1, p>.05$]. While still of some concern in terms of sample selection, it was

not unexpected that receptive vocabulary skills would be more directly linked to reading comprehension than reading accuracy. The absence of significantly poorer comprehension may reflect self-selection factors operating among potential reading impaired subjects. For example, impaired readers who volunteered to participate in a project known to include reading tasks may have been those least distressed by their reading problems, including children whose reading comprehension was more comparable with that of their normally achieving peers. Despite the absence of statistically significant between-group differences in comprehension on individual ANOVA, repeated measures analysis of covariance (MANCOVA) based upon a split-plot design, in which type of test (Comprehension vs. Reading) was the within-group measure and PPVT-R score was the covariate, revealed a significant group by type of test interaction [$F(1,37)=13.1$; $p<.001$] comparable to that found without PPVT-R as covariate.

Taken together these findings verified that the IR group: a) was grossly within normal limits in level of cognitive functioning; b) performed at a level below expectations based on IQ on standardized measures of both reading comprehension and accuracy, and c) differed significantly from the normal group on measures of reading, particularly reading accuracy, even when the

scores were controlled for estimated between-group differences in cognitive functioning.

Word Class Differences in Reading Accuracy

Single-Word Reading

To examine word-class differences in single word reading (word recognition), proportion scores, calculated by dividing the number of correctly read words from each word class by the total number of words in that class, i.e., 31 words, were obtained for each subject in each word class. The mean proportions for each group are shown in Table 2-7.

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Table 2-7

Reading Accuracy By Word Class -- Single Word Reading:
Mean Proportion of Words From Each Class Read Correctly

	Mean Proportion Correct (Std.Dev.)	
	<u>Verbs</u>	<u>Nouns</u>
Normal Readers (N=20)	.89 (.12)	.94 (.08)
Impaired Readers (N=20)	.46 (.27)	.58 (.22)

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Between- and within-group differences in proportion scores were analyzed via split-plot design (SPF-2.2) with repeated measures analysis of variance (MANOVA) with group as the independent variable and word class (noun vs. verb)

as the within-group (repeated) measure. As expected, overall the NR group performed better than IR group [$F(1,38)=46.3$; $p<.0001$]. Significant between group differences in each word class supported Hypothesis 1a, that impaired readers read both nouns and verbs less accurately than normal readers. A significant main effect was also obtained for word class [$F(1,38)=48.3$; $p<.0001$], with reading of verbs more significantly impaired than reading of nouns. However, a significant group by word class interaction was obtained [$F(1,38)=8.0$; $p<.01$] in which the noun-verb differential was more striking for the IR group than the NR group (Table 2-7). A priori (planned) comparisons revealed that impaired readers exhibited significantly better accuracy when reading nouns than verbs ($p<.0001$), and that this difference in accuracy remained significant, relative to noun-verb differences exhibited by normal readers ($p<.01$), thereby supporting Hypothesis 1b. All main, interaction, and planned comparison effects remained significant when the PPVT-R score was partialled out [Group: $F(1,37) = 14.5$; $p<.001$; Word Class: $F(1,37) = 47.0$, $p<.0001$; Group x Word Class interaction: $F(1,37) = 7.8$, $p<.01$].

Oral Passage Reading

To investigate the effect of contextual cues on accuracy of reading words from different word classes, the

performances of the NR and IR groups were compared on words from the single word reading list, as they were encountered in the context of the GORT-R passages. In contrast with the single-word reading analysis in which each subject was administered the full 62-word single-word reading test, each child read an individualized subset of words, based upon the specific passages they read between basal and ceiling reading levels. Thus, the number of target words to which subjects were exposed varied with the number of passages read. Proportion scores were calculated by dividing the number of correctly read words from each word class by the total number of words encountered from that class in the context of the passages read. Proportion scores are presented for each word class, by group, in Table 2-8.

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Table 2-8

Reading Accuracy By Word Class -- Oral Passage Reading:
Mean Proportion of Words From Each Class Read Correctly

	Mean Proportion Correct (Std.Dev.)	
	<u>Verbs</u>	<u>Nouns</u>
Normal Readers (N=20)	.96 (.07)	.95 (.06)
Impaired Readers (N=20)	.77 (.21)	.81 (.14)

=====

Whereas the target word lists had themselves been matched

for word frequency and number of syllables; the order in which the words occurred in the passages did not permit the same precision in matching for frequency and number of syllables. Nevertheless, the grossly increasing word difficulty in successive passages suggested that nouns and verbs were of generally comparable difficulty for each subject.

Between- and within-group differences in proportion scores were analyzed via split-plot design (SPF-2.2) with repeated measures analysis of variance (MANOVA) with group as the independent variable and word class as the within-group (repeated) measure. The NR group correctly read a significantly greater proportion of nouns and verbs than the IR group [$F(1,38) = 26.3; p < .0001$] (Table 2-8), thereby supporting Hypothesis 2a. The main effect for group remained significant when the effect of PPVT-R score was partialled out [MANCOVA: $F(1,37) = 13.4; p < .001$]. No significant main effect for word class and no significant group by word-class interaction were obtained. Hypothesis 2b, that impaired readers exhibit more verb than noun errors in passage reading, was not confirmed by a priori comparison ($p > .05$). These data suggested that impaired readers used contextual cues to improve the level of verb reading to that of their reading of nouns.

Despite the absence of significant group differences between the word classes in passage reading accuracy,

Pearson correlations suggested that the accuracy with which the IR group read verbs on the GORT-R better predicted overall reading performance than noun-reading accuracy. GORT-R Verb score, i.e., the proportion of verbs read correctly in the context of passage reading, was significantly positively correlated with GORT-R Comprehension Score ($r=.54$, $p<.05$), Passage Score ($r=.73$, $p<.01$), overall single word reading score ($r=.78$, $p<.01$), and verb accuracy score on the single word reading test ($r=.78$, $p<.01$). Accuracy of reading nouns on the GORT-R, in contrast, was nonsignificantly correlated with all of the critical measures (all $p>.05$). For normal readers, accuracy of verb reading on the GORT-R predicted only single word reading ($r=.66$, $p<.01$). Accuracy of noun reading on the GORT-R was significantly negatively correlated with GORT-R Comprehension ($r= -.54$, $p<.05$).

Lexical Retrieval--Confrontation Naming

Confrontation naming and word recognition were both presumed to depend upon ability to access word meaning from the mental lexicon. If impaired readers exhibited greater deficits reading verbs than nouns, they would be expected to exhibit deficits in action naming at least as great as their already established deficits in object naming. To compare action and object naming performances of normal and impaired readers, data were analyzed via

split-plot design (SPF-2.2) with repeated measures analysis of variance (MANOVA), with group as the independent variable and type of naming (action versus object naming) as the within-group (repeated) variable (Table 2-9).

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Table 2-9

Confrontation Naming: Mean Raw Score By Word Class and Group

Mean Confrontation Naming Raw Scores (Std.Dev.)		
	<u>Actions</u>	<u>Objects</u>
Normal Readers (N=20)	26.30 (2.81)	26.60 (2.37)
Impaired Readers (N=20)	21.55 (3.03)	21.75 (3.94)

Note. Maximum Correct Raw Score = 35.

=====
The NR group performed better overall than the IR group [$F(1,38) = 27.8$; $p < .0001$]. The main effect for group remained statistically significant when PPVT-R scores were entered as a covariate [$F(1,37) = 4.1$; $p = .05$], indicating that relative deficits in action and object naming exhibited by the IR group could not be solely attributed to their lower receptive vocabularies or to a lower estimated level of cognitive functioning. Hypothesis 3a, that impaired readers name both nouns and verbs less accurately than normal readers, was thereby supported. No significant main effect was found for type of test (action naming versus object naming), nor was any significant

group by test interaction revealed. This finding was consistent with expectations for normal readers, given the fact that the action and object naming tasks were intentionally developed to incorporate items of comparable frequency and difficulty. However, Hypothesis 3b, that impaired readers are more impaired at action than object naming, was not confirmed by a priori comparison ($p > .05$).

Action Naming -- Cuing Conditions

To clarify which factors facilitated and hindered action naming, performances of normal and impaired readers were analyzed with respect to the four sets of stimulus or "cuing" conditions included in the action naming task. The pictures were characterized by one of four "cuing" conditions: a) the similarly-named object condition; b) the direct object condition; c) presence of both types of "cue"; and d) absence of both types of "cue." Mean raw scores for the items in each "cuing" condition by group are shown in Table 2-10.

Repeated measures analysis of variance (MANOVA) was performed on a split-plot (SPF-2.4) design, with group as independent variable and "cuing" condition as the within-groups factor (Table 2-10). MANOVA revealed a significant main effect for group [$F(1,38) = 31.6$; $p < .0001$], with normal readers performing better overall ($\bar{x} = 5.44$, $sd = .52$) than impaired readers ($\bar{x} = 4.44$, $sd = .58$). A

significant main effect was also obtained for cuing condition [$F(3,114)=8.9$; $p<.0001$], in which subjects in the combined groups of normal and impaired readers named actions most accurately when a similarly-named object was present in the picture, either as the sole "cue" ($\bar{x} = 5.38$, $sd = .98$) or in combination with a direct object "cue" ("both cue" condition) ($\bar{x} = 5.15$, $sd = 1.00$). Weakest performances were obtained in the presence of direct object cues alone ($\bar{x} = 4.65$, $sd = 1.12$) and in the absence of "cues" altogether ($\bar{x} = 4.58$, $sd = .90$).

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Table 2-10

Action Naming: Mean Raw Score By "Cuing" Condition and Group

<u>Cuing Condition</u>	<u>Normal Readers</u> (N=20)	<u>Impaired Readers</u> (N=20)
Both Cues Present	5.80 (SD=0.69)	4.50 (SD=0.83)
Similarly-named Object Present	5.80 (SD=0.83)	4.95 (SD=0.94)
Direct Object Present	5.30 (SD=1.08)	4.00 (SD=0.73)
Neither Cues Present	4.85 (SD=0.67)	4.30 (SD=1.03)

Note. Maximum Correct Raw Score = 7.

=====
The interaction between group and cuing condition was nonsignificant. However, inspection of the data suggested that impaired readers performed markedly worse than normal readers on the two sets of items in which customarily-associated direct objects were pictured, i.e., in the direct object and "both cue" conditions. In fact when

PPVT-R score was introduced as a covariate, a priori (planned) comparisons revealed significant between group differences under only those two conditions (Direct Object: $p < .01$; Both Cue: $p < .05$). This finding was further supported by evidence of a significant group x cuing condition interaction for split plot (SPF 2.2) repeated measurements analysis of scores on combined subsets of items representing conditions of direct object present and direct objects absent [$F(1,38) = 5.77, p < .05$]. Thus, the impaired readers used direct object cues, both alone and in combination with similarly-named object cues, less efficiently than normal readers, thus supporting Hypothesis 4a. In support of Hypothesis 4b, a priori comparisons revealed that impaired readers exhibited more accurate action naming in the similarly-named object cue condition than in the direct object cue condition ($p < .0001$). The performances of normal readers, in contrast, did not differ significantly between the two cuing conditions ($p > .05$). This latter finding was consistent with expectations in that cuing sets were comprised of items of comparable frequency and difficulty.

Phrase-Form Responses: The most salient qualitative difference between the groups' responses was that the impaired readers spontaneously offered more phrase-form responses than normal readers (IR, $\bar{x} = 5.1, sd = 4.2$; NR, $\bar{x} = 2.0, sd = 2.8$) [$F(1,38) = 7.6; p < .01$]. That is, despite

instructions to provide "one word" responses, IR children responded with an action word linked with an object (e.g., "a lady driving," "jumping with a parachute," "making a statue," "on a swing") more than twice as often as the NR children. Phrase-form responses did not themselves constitute errors; they simply required that the examiner cue the subject to "give me one word that tells what the person is doing." However, 82 percent of the phrase-form responses of the NR group and 93 percent of the phrase-form responses of the IR group were followed by a naming error (e.g., "jumping with a parachute...Q...falling").

The low frequency of correct naming following phrase-form responses suggested that phrase-form responses in action naming mirror the pattern of "circumlocution" observed in some cases of impaired noun retrieval. That is, when a precise action name could not be immediately retrieved, a more descriptive response was offered. The relative frequency of descriptive error (i.e., phrase-form and circumlocutory) responses to action and object naming stimuli in the two groups was examined. Because of overall between-group differences in error frequency, it was necessary to compare the ratio of phrase-form or circumlocutory error responses to the total number of naming errors in the respective word class (Table 2-11). Data were analyzed via split-plot design (SPF-2.2) with repeated measures analysis of variance (MANOVA) with group

as the independent variable and the proportion of descriptive errors occurring within each word class, as the within-group (repeated) variable.

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Table 2-11

Proportion of Phrase-Form and Circumlocutory Errors For Each Group¹; Post Hoc Tukey HSD Analysis on Descriptive Errors By Word Class and Group

	Mean Proportion Circumlocutory Errors ² (Std.Dev.)	
	Action Naming	Object Naming
Normal Readers (N=20)	.18 (.21)	.09 (.15)
Impaired Readers (N=20)	.33 (.24)	.11 (.11)

Post Hoc Tukey HSD Analysis

	NR Ac.Nmg.	NR Ob.Nmg.	IR Ac.Nmg.	IR Ob.Nmg.
NR Action Naming	--	--	--	--
NR Object Naming	NS	--	--	--
IR Action Naming	**	***	--	--
IR Object Naming	NS	NS	***	--

¹IR=Impaired Readers (n=20) NR=Normal Readers (n=20)

² Mean proportion of phrase-form to total action naming errors; Mean proportion of circumlocutions to total object naming errors.

Within and Between Group Differences MANOVA with Tukey HSD post hoc analysis

NS=not significant

** p<.01

*** p<.001

=====
A trend toward fewer descriptive errors overall by the NR group [$F(1,38) = 3.2, p = .08$], and significantly more

descriptive errors on verb than noun stimuli [$F(1,38)=22.9, p<.001$] were detected. Post hoc Tukey HSD analysis of the significant group by word class interaction [$F(1,38)=4.3, p<.05$] revealed significant between group differences in verb circumlocutions. Specifically, the IR and NR groups produced comparable proportions of noun circumlocutions, but IR's produced more descriptive verb responses than the NR's ($p<.01$). Moreover, IR subjects made more descriptive errors when naming actions than objects ($p<.001$); whereas proportions of noun and verb circumlocutions produced by NR subjects did not differ significantly ($p>.05$), (Table 2-11). Both the main effect for word class [$F(1,37)=22.32, p<.0001$] and the interaction effect [$F(1,37)= 4.23, p<.05$] remained significant when PPVT-R Standard Score was introduced as a covariate. The main effect for group remained nonsignificant when PPVT-R Standard Score was introduced as a covariate [$F(1,37) <1$].

The proportion of phrase form errors to total errors in each of the four previously described "cuing" conditions was compared to determine whether specific types of stimuli elicited more frequent descriptive errors. Repeated measures analysis of variance was employed in a split-plot design (SPF-2.4) to examine ratio of phrase-form to total errors, with group as the independent variable and "cuing" condition as the within

group (repeated) variable. No significant main effects were found for group [$F(1,30) = 1.3, p > .05$] or "cuing" condition [$F(3,90) = 1.6, p > .05$]. The interaction of group x cuing condition was also nonsignificant [$F(3,90) < 1$]. These findings indicated that stimuli from each cuing condition exhibited a comparable proportion of phrase-form to total errors within each group.

Error Analysis: More specific analyses of the frequency with which specific types of errors occurred by type of error, cuing category, and group revealed no statistically significant findings.

Lexical Retrieval-- Synonym Generation

To investigate whether verbs are more or less difficult to retrieve than nouns in general, performances of normal and impaired readers were evaluated on a synonym generation task. Mean raw scores for the synonym generation task, by word class and group, are shown in Table 2-12.

Repeated measures analysis of variance (MANOVA) was employed in a split-plot design (SPF-2.2) to examine within- and between-group differences in synonym generation. A significant main effect for group was obtained in which impaired readers exhibited greater difficulty generating synonyms than normal readers

[F(1,38) = 14.69; p<.001].

=====
Table 2-12

Synonym Generation: Mean Raw Score By Word Class and Group

	Mean Synonym Generation Raw Score (Std.Dev.)	
	<u>Verbs</u>	<u>Nouns</u>
Normal Readers (N=20)	3.80 (1.3)	4.70 (1.0)
Impaired Readers (N=20)	2.65 (1.3)	3.25 (1.5)

Note. Maximum Score = 6.

=====

This finding supported Hypothesis 5a, that impaired readers are less skilled than normal readers at generating synonyms for noun and verb targets. However, the main effect for group became nonsignificant when PPVT-R scores were included as a covariate [F(1,37) = 1.8; p>.05]. This finding suggested that between group differences in synonym generation were more likely a function of generally impoverished lexical knowledge or generally weak lexical retrieval than of a deficit specific to impaired readers.

A significant main effect was also established for word class [F(1,38) = 11.8; p<.01], with verbs eliciting fewer synonyms than nouns. The main effect for word class remained significant when PPVT-R scores were included as a covariate [F(1,37) = 11.5; p<.01]. Despite the absence of

a significant group x word class interaction, a priori comparisons revealed that the superiority in generating synonyms to noun targets was more apparent in the normal than impaired readers. Whereas, impaired readers also demonstrated a verb < noun trend, that pattern did not achieve statistical significance ($p=.06$), normal readers retrieved significantly more noun than verb synonyms ($p<.01$). Pearson correlations revealed an additional finding of interest: that normal readers' synonym generation scores for nouns and verbs were not significantly correlated ($p>.05$). Taken together, the findings suggest that these synonym generations tasks did not elicit identical word retrieval processes. While this may be attributed to inherent differences between nouns and verbs, per se, it is more likely, that these differences reflect more subtle psycholinguistic differences (e.g., in hierarchical position) among the target words themselves. Thus, despite partial support for Hypothesis 5b, that synonyms for verbs are more difficult to retrieve than synonyms for equally "familiar" nouns, it was difficult to confidently identify the factors which might have contributed to this pattern.

Receptive Vocabulary

To determine the extent to which impairments in lexical retrieval and reading were related to underlying

deficits in receptive vocabulary, Pearson correlations between PPVT-R Standard Score and the reading measures were examined (Table 2-13).

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Table 2-13

Pearson Correlations Between PPVT-R Scores¹ and Reading Scores For Each Group

	<u>Normal Readers (N=20)</u>		
	<u>PPVT-R STD.</u>	<u>PPVT-R VERB</u>	<u>PPVT-R NOUN</u>
GORT-R Comprehension	.55*	.25 ^{NS}	.29 ^{NS}
GORT-R Passage	.66**	.46*	.29 ^{NS}
GORT-R Acc: Verbs	-.01 ^{NS}	.29 ^{NS}	.29 ^{NS}
GORT-R Acc: Nouns	-.36 ^{NS}	.01 ^{NS}	-.09 ^{NS}
Single Word Reading	.30 ^{NS}	.42 ^{NS}	.36 ^{NS}
Single Word: Verbs	.29 ^{NS}	.40 ^{NS}	.43 ^{NS}
Single Word: Nouns	.28 ^{NS}	.43 ^{NS}	.23 ^{NS}
	<u>Impaired Readers (N=20)</u>		
	<u>PPVT-R STD.</u>	<u>PPVT-R VERB</u>	<u>PPVT-R NOUN</u>
GORT-R Comprehension	.66**	.45*	.06 ^{NS}
GORT-R Passage	.61**	.51*	.03 ^{NS}
GORT-R Acc: Verbs	.40 ^{NS}	.45*	.14 ^{NS}
GORT-R Acc: Nouns	-.36 ^{NS}	-.12 ^{NS}	.05 ^{NS}
Single Word Reading	.44*	.64**	-.01 ^{NS}
Single-Word: Verbs	.46*	.66**	-.05 ^{NS}
Single-Word: Nouns	.41 ^{NS}	.58**	.04 ^{NS}

¹ PPVT-R Scores: PPVT-R STD.= PPVT-R Standard Score; PPVT-R VERB Score = Proportion of Verbs Correctly Answered; PPVT-R NOUN Score = Proportion of Nouns Correctly Answered.

Pearson Correlations

^{NS} = not significant (p>.05)
* = p<.05 (2-tailed, df=18)
** = p<.01 (2-tailed, df=18)

=====

For both groups, PPVT-R scores were significantly positively correlated with GORT-R Comprehension and Passage scores. Among impaired readers, PPVT-R was positively correlated with the overall and verb scores on the test of single-word reading ($p < .05$) but not with the noun score. Among normal readers, in contrast, PPVT-R Standard Score was nonsignificantly correlated with single word reading. These findings suggested that both reading comprehension and accuracy are directly related to the strength or weakness of the reader's receptive vocabulary, i.e., by the reader's ability to recognize "real" words and to understand their meaning. These findings supported Hypothesis 6a, that receptive vocabulary is correlated with reading performance.

To determine the extent to which word retrieval performances were correlated with receptive vocabulary, Pearson correlations between PPVT-R Standard Score and retrieval scores were examined (Table 2-14). For both groups, PPVT-R was significantly positively correlated with object naming ($p < .01$). PPVT-R was positively correlated with action naming performance for the impaired readers only ($p < .05$). These findings suggested that confrontation naming of objects is directly related to the strength or weakness of the reader's receptive vocabulary, regardless of the individual's reading proficiency. Impaired readers were vulnerable to deficits in naming

both objects and actions when their receptive vocabulary skills were weak. There were no significant correlations between PPVT-R score and synonym generation for noun or verb targets for either group. The absence of a significant relationship between receptive vocabulary and synonym generation may be a function of the constricted range of word difficulty within that test.

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Table 2-14

Pearson Correlations Between PPVT-R Scores¹ And
Retrieval Measures For Each Group

Normal Readers (N=20)

	<u>PPVT-R STD.</u>	<u>PPVT-R VERB</u>	<u>PPVT-R NOUN</u>
Action Naming	.33 ^{NS}	.24 ^{NS}	.59 ^{**}
Object Naming	.57 ^{**}	.09 ^{NS}	.66 ^{**}
Synonym Gen.-Verbs	.23 ^{NS}	.21 ^{NS}	.39 ^{NS}
Synonym Gen.-Nouns	.39 ^{NS}	.26 ^{NS}	.38 ^{NS}

Impaired Readers (N=20)

	<u>PPVT-R STD.</u>	<u>PPVT-R VERB</u>	<u>PPVT-R NOUN</u>
Action Naming	.51 [*]	.45 [*]	.34 ^{NS}
Object Naming	.62 ^{**}	.61 ^{**}	.23 ^{NS}
Synonym Gen.-Verbs	.36 ^{NS}	.59 ^{**}	-.04 ^{NS}
Synonym Gen.-Nouns	.36 ^{NS}	.57 ^{**}	.41 ^{NS}

¹ PPVT-R Scores: PPVT-R STD.= PPVT-R Standard Score; PPVT-R
VERB Score = Proportion of Verbs Correctly Answered;
PPVT-R NOUN Score = Proportion of Nouns Correctly Answered.

Pearson Correlations

NS = not significant (p>.05)

* = p<.05 (2-tailed, df=18)

** = p<.01 (2-tailed, df=18)

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These findings partially supported Hypothesis 6a, that receptive vocabulary is correlated with retrieval of nouns and verbs. All findings related to PPVT-R Standard Scores are to be regarded cautiously, however, because of the typical correlation between that score and level of general cognitive functioning.

Word-Class Analysis

To the author's knowledge, no previous studies have explored word-class differences in receptive vocabulary. PPVT-R responses were submitted to word-class analysis in which a PPVT-R "noun score" was obtained for each subject by dividing the number of correct responses to unambiguous noun items by the total number of unambiguous noun items encountered; a PPVT-R "verb score" was obtained in a similar manner. PPVT-R noun and verb knowledge scores, thus defined as the proportion of correct responses to unambiguous nouns and verbs encountered up to and including the ceiling item, were calculated from each subject's responses during standard administration of the PPVT-R (Table 2-15). Proportion or ratio scores represented one way of meaningfully comparing impaired and normal readers which would be unbiased by the between-group differences in overall PPVT-R performance. Lower scores reflected a smaller ratio of correct to attempted

items, rather than an absolute number of items known. As such, PPVT-R noun and verb scores estimated the integrity of lexical knowledge.

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Table 2-15

PPVT-R Noun And Verb Knowledge Scores¹ For Each Group

	Mean Percent Correct	
	<u>Normal Readers</u> (N=20)	<u>Impaired Readers</u> (N=20)
PPVT-R Verb Score	73.1% (SD= 8.3%)	65.1% (SD=15.8%)
PPVT-R Noun Score	75.0% (SD=10.8%)	67.9% (SD= 8.8%)

¹ PPVT-R Noun Knowledge Score = Percent of Noun Items between
PPVT-R Starting Item and Ceiling Answered Correctly
PPVT-R Verb Knowledge Score = Percent of Verb Items between
PPVT-R Starting Item and Ceiling Answered Correctly

=====
PPVT-R noun and verb scores were submitted to repeated measures analysis of variance (MANOVA) in a split-plot (SPF-2.2) design in which group was the independent variable and word class was the (repeated) within-group measure. A significant main effect was obtained for group, with normal readers performing better overall than impaired readers [$F(1,38) = 9.4; p < .01$]. No significant main effect was obtained for word class [noun versus verb score; $F(1,38) < 1; p > .05$]; nor was a significant group by word class interaction obtained [$F(1,38) < 1; p > .05$]. Thus, Hypothesis 6b, that impaired

readers are characterized by less accurate verb knowledge than noun knowledge, was not supported.

Correlations of PPVT-R Noun and Verb Knowledge scores with reading and retrieval measures are presented in Tables 2-13 and 2-14. For the normal readers, PPVT-R noun and verb scores were comparably and significantly correlated with PPVT-R Standard Scores and, therefore, contributed comparably to the variance in those Standard Scores (PPVT-R Noun: $r=.51$, $p<.05$; PPVT-R Verb: $r=.52$, $p<.05$). For impaired readers, the PPVT-R verb score was also significantly positively correlated with overall PPVT-R performance ($r=.60$, $p<.01$). In contrast, PPVT-R noun score was uncorrelated with PPVT-R Standard Score for the IR group ($r=-.05$). Despite the absence of a predominant pattern of mean differences between PPVT-R noun and verb scores, PPVT-R verb scores better predicted overall PPVT-R performance for reading impaired children. Moreover, in comparison with PPVT-R noun and Standard Scores, PPVT-R verb score emerged from correlation analyses as significantly related to GORT-R Comprehension, GORT-R Passage Score, and single word reading for the impaired readers. In fact, for the IR group, PPVT-R verb score emerged as significantly positively correlated with each reading and retrieval measure studied (Tables 2-13 and 2-14); whereas PPVT-R noun score was nonsignificantly correlated with every reading and retrieval measure. For

normal readers, in contrast, few significant correlations emerged. Verb knowledge was correlated only with PPVT-R and GORT-R Passage Scores, while noun knowledge was correlated only with PPVT-R and confrontation naming measures. Deficits in receptive vocabulary for verbs appear to make impaired readers particularly vulnerable to difficulties accessing information from semantic memory and extracting meaning from written language. This would suggest that verbs contribute more critically than nouns to those processes, particularly where reading impaired children are concerned.

Predictors of Word Retrieval

To further explicate the relationship between receptive noun and verb knowledge and the retrieval measures, forward stepwise multiple regression analyses were performed. In forward stepwise analysis, the independent variable which contributes the greatest portion of the variance is entered into the regression analysis first. Remaining variables are then entered in order of decreasing contribution, based upon the partial correlation of each with the dependent variable, that is, after the effects of previously entered variables are partialled out. This stepwise method helps to compensate for the interrelationship among variables by basing computations only on the unique contribution offered by

each variable. In these analyses, each of the word retrieval measures, *viz.*, action naming, object naming, synonym generation for verbs and synonym generation for nouns, served as dependent variables, while PPVT-R verb and noun scores were introduced, separately and in combination, as independent variables.

Normal Readers

For the NR group, PPVT-R noun score, alone, reliably predicted performance on each of the confrontation naming measures [object naming: Adjusted $R^2=.40$, $F(1,18)=13.77$, $p<.01$; action naming: Adjusted $R^2=.32$, $F(1,18)=9.80$, $p<.01$] (Appendices F-1a and F1b). Neither PPVT-R noun score nor verb score reliably predicted synonym generation for verbs or nouns.

Impaired Readers

For the IR group PPVT-R verb and noun scores in combination emerged as significant predictors of action naming, object naming and synonym generation for nouns (Appendices F-2a, F-2b, F-2c). In contrast with findings for normal readers, PPVT-R verb score contributed to a greater extent than noun score to the total variance of each of the three retrieval measures. PPVT-R verb score, alone, was the better predictor of synonym generation for verbs (Appendix F-2d). These findings supported Hypothesis

6c that, for impaired readers, verb knowledge is a more significant predictor of word retrieval than noun knowledge.

Predictors of Reading Performance

To identify the best predictors of performance on measures of reading, forward stepwise multiple regression analyses were performed on each of three dependent variables: GORT-R Comprehension Score, GORT-R Passage Score, and single word reading score. PPVT-R noun and verb knowledge scores were not, in and of themselves, the best predictors of reading performance. Consequently the contributions of other independent variables were also examined. Of the retrieval and lexical knowledge factors investigated in this study, only those independent variables expected to have significant impact on the reading variables, *viz.*, object naming score, scores on each of the four action naming "cuing" conditions, and PPVT-R verb and noun scores, were included as independent variables in the regression analysis. Synonym generation scores were omitted from analysis due to their nonsignificant correlations with reading measures. Action naming score was omitted from analysis in favor of separately entering the scores on the individual "cuing" conditions which comprised that task, because of the variability with which the subtasks discriminated between

normal and impaired readers. PPVT-R noun and verb knowledge scores were entered separately as measures of lexical knowledge because the divergence in their correlational data suggested they would provide more specific information than the more global PPVT-R Standard Score. Subsequent analyses confirmed that inclusion of synonym generation and PPVT-R Standard scores and substitution of action naming score for the individual "cuing" condition subscores resulted in identification of fewer statistically significant independent variables and weakened the overall statistical significance of the regression equations.

Regression analyses were first performed on the combined sample of all IR and NR subjects. Then performances of the impaired and normal readers were analyzed separately to identify the relevant predictors for each group. For the combined sample of impaired and normal readers, four independent variables emerged as significant predictors of the reading variables: PPVT-R verb score, object naming score, and "direct object" and "neither cue" scores on the action naming task. The regression equations derived from those four variables were the most concise and statistically significant. Analysis of variance (ANOVA) performed on those regression equations for each dependent variable revealed statistically significant ratios of mean square regression

to mean square residual ($p < .0001$), indicating that the regression models fit the data well. The same four variables also emerged, alone or in combination, as the most significant predictors of each reading variable for the separate NR and IR groups.

GORT-R Comprehension

Combined IR and NR Groups. Object naming score, action naming "direct object cue" and "neither cue" scores, and PPVT-R verb score emerged as predictors of GORT-R Comprehension Score (Appendix G-1a). The regression equation, $27.24 + 2.03 (\text{OBJECT NAMING SCORE}) + 5.01 (\text{ACTION NAMING "DIRECT OBJECT CUE" SCORE}) - 4.49 (\text{ACTION NAMING "NEITHER CUE" SCORE}) + 25.30 (\text{PPVT-R VERB SCORE})$, accounted for 52% of the total variance in GORT-R Comprehension Score [$F(4,35) = 11.62, p < .0001$]. Although the latter two variables contributed nonsignificantly to the four-variable regression model, their inclusion in the equation resulted in a higher coefficient of determination (Adjusted R^2) than their exclusion altogether. Nevertheless, two three-variable, two two-variable and one single-variable models emerged as comparably reliable predictors of GORT-R Comprehension score for the full sample, each accounting for from 44 to 50% of the variance in GORT-R Comprehension (Appendices G-1b through G-1f).

NR Group. Regression analysis based upon the four

independent variables identified above yielded nonsignificant results [$F(4,15)=2.78, p>.05$]. However, omission of PPVT-R verb score as an independent variable resulted in a statistically significant three-variable regression equation [$F(3,16)= 3.91, p<.05$] (Appendix G-2). Significant predictors of GORT-R Comprehension Score for the NR group, as in the combined sample, were: object naming score and action naming "direct object cue" score. Again action naming "neither cue" score contributed nonsignificantly; however, omission of that variable from analysis resulted in a smaller coefficient of determination (Adjusted $R^2=.22$) and nonsignificant t-tests for each of the two remaining variables [Object Naming: $t(36)=1.47, p>.05$; Direct Object Cue: $t(36)=1.46, p>.05$]. The regression equation, $36.23 + 3.11$ (OBJECT NAMING SCORE) + 7.08 (ACTION NAMING "DIRECT OBJECT CUE" SCORE) - 10.54 (ACTION NAMING "NEITHER CUE" SCORE), accounted for 31% of the total variance in GORT-R Comprehension Score for the NR group.

IR Group. Regression analysis based upon the four significant independent variables identified for the combined sample yielded a nonsignificant regression equation for the IR group [$F(4,15)=2.12, p>.05$]. The best predictor of reading comprehension for the IR group was object naming score alone (Appendix G-3a). The regression equation $51.81 + 1.65$ (OBJECT NAMING SCORE) predicted 27%

of the variance in GORT-R Comprehension for the IR group [$F(1,18) = 8.01, p < .05$]. Consideration of PPVT-R verb score alone resulted in a statistically significant regression equation (Appendix G-3b). The equation $66.02 + 33.36$ (PPVT-R VERB SCORE) accounted for 16% of total variance in GORT-R Comprehension for the IR group [$F(1,18) = 4.58, p < .05$].

Object naming performance, alone or in combination with other variables, was the most consistent predictor of GORT-R Comprehension for both normal and impaired readers. It was, by no means, the only predictor. For the NR group, object naming score alone predicted GORT-R Comprehension less reliably than when combined with two subscores from the action naming test (direct object and neither cue scores). For the IR group, PPVT-R verb score was a statistically significant predictor of GORT-R Comprehension as object naming score. In contrast with PPVT-R verb score, PPVT-R noun score did not emerge as a significant predictor of comprehension for either group. Thus, the regression analyses partially supported Hypothesis 6d that, for the IR group, verb knowledge better predicts reading performance, specifically GORT-R Comprehension, than noun knowledge.

GORT-R Passage

Combined IR and NR Groups. Significant predictors of

GORT-R Passage Score for the combined sample were: action naming "direct object cue" score, PPVT-R verb score, object naming score, and action naming "neither cue" score (Appendix H-1). The resulting regression equation, $-10.14 + 9.61 (\text{ACTION NAMING "DIRECT OBJECT CUE" SCORE}) + 60.38 (\text{PPVT-R VERB SCORE}) + 1.93 (\text{OBJECT NAMING SCORE}) - 6.75 (\text{ACTION NAMING "NEITHER CUE" SCORE})$, accounted for 68% of the total variance in GORT-R Passage Score [$F(4,35) = 21.43, p < .0001$].

NR Group. Regression analysis based upon the four independent variables identified above yielded less statistically significant results than when PPVT-R verb score was deleted as an independent variable. Significant predictors of GORT-R Passage Score for the NR group were: action naming "direct object cue" score, action naming "neither cue" score, and object naming score (Appendix H-2). The regression equation, $54.37 + 11.85 (\text{ACTION NAMING "DIRECT OBJECT CUE" SCORE}) - 16.51 (\text{ACTION NAMING "NEITHER CUE" SCORE}) + 2.59 (\text{OBJECT NAMING SCORE})$ accounted for 61% of the total variance in GORT-R Passage Score for the NR group [$F(3,16) = 10.77, p < .001$]. When considered individually, action naming "direct object cue" [Adjusted $R^2 = .33, F(1,18) = 10.56, p < .01$] and the PPVT-R verb score [Adjusted $R^2 = .17, F(1,18) = 4.76, p < .05$] each emerged as statistically significant predictors of GORT-R Passage score, although less significant than the three-variable

model. In contrast, neither object naming score nor action naming "neither cue" score was a significant predictor of GORT-R Passage score when considered individually.

IR Group. Regression analysis based upon the four independent variables which had produced significant results for the combined groups, yielded nonsignificant results for the IR group alone [$F(4,15)=2.67, p>.05$]. However, deletion of the object naming and action naming "neither cue" scores as independent variables resulted in a statistically significant regression equation [$F(2,17)=5.46, p<.05$] (Appendix H-3a). The best predictors of GORT-R Passage score for the IR group were: PPVT-R verb score and action naming "direct object cue" score in the regression equation, $.79 + 66.56$ (PPVT-R VERB SCORE) + 8.46 (ACTION NAMING "DIRECT OBJECT CUE" SCORE). Nevertheless, comparably significant ratios of predicted-to-total variance were obtained from the consideration of object naming score and PPVT-R verb score individually (Appendices H-3b and H-3c).

These findings indicate that object naming performance, alone or in combination with other variables, was the most consistent predictor of GORT-R Passage score for both normal and impaired readers. As was the case in predicting comprehension, it was not the only predictor. For the NR group, object naming score alone was not a significant predictor GORT-R Passage score. Only when

combined with two subscores from the action naming test (direct object and neither cue scores) did object naming contribute significantly to the regression equation. For the IR group, PPVT-R verb score was as significant a predictor of GORT-R Passage score as object naming score. Again, PPVT-R noun score did not emerge as a significant predictor of Passage score for either group. Thus, the regression analyses partially supported Hypothesis 6d, that verb knowledge better predicts impaired readers' reading performances, specifically GORT-R Passage score, than noun knowledge.

Single Word Reading

Combined IR and NR Groups. The independent variables, PPVT-R verb score, object naming score, action naming "direct object cue" score, and action naming "neither cue" score were components of a regression equation which accounted for 61% of the variance in single word reading performance for the combined sample [$F(4,35)=16.35$, $p<.0001$] (Appendix I-1a). However, exclusion of the nonsignificant variable, "neither cue" score, did not appreciably change the coefficient of determination or the statistical significance of the regression model (Appendix I-1b). The regression equation which resulted from the remaining three variables, $-0.71 + 0.82$ (PPVT-R VERB SCORE) + 0.02 (OBJECT NAMING SCORE) + 0.07 (ACTION NAMING

"DIRECT OBJECT CUE" SCORE) accounted for 58% of the total variance in single word reading [$F(3,36) = 19.06$, $p < .0001$]. Two two-variable regression equations predicted single word reading score with virtually the same accuracy as the three-variable equation. An equation based on the independent variables, object naming score and PPVT-R verb score, and an equation based on the variables "direct object cue" score and PPVT-R verb score each accounted for 54% of total variance in single word reading (Appendices I-1c and I-1d).

NR Group. Regression analysis based upon the the four original independent variables was not statistically significant. The best predictors of single word reading for the NR group were: object naming score, "direct object cue" score, and "neither cue" score. The regression equation based on those three variables, *viz*, $0.47 - 0.09$ ("NEITHER CUE" SCORE) + 0.02 (OBJECT NAMING SCORE) + 0.05 ("DIRECT OBJECT CUE" SCORE) , accounted for 30% of the variance in single word reading [$F(3,16)=3.69$, $p < .05$] (Appendix I-2).

IR Group. Regression analysis based upon the four original independent variables yielded nonsignificant results for the IR group. The best predictors of single word reading for the IR group were PPVT-R verb score and "direct object cue" score [$\text{Adjusted } R^2 = .40$; $F(2,17) = 7.31$, $p < .01$] (Appendix I-3a). However, PPVT-R verb score,

considered alone, was nearly as reliable a predictor of single word reading for the IR group [Adjusted $R^2=.37$; $F(1,18)=12.17$, $p<.01$] (Appendix I-3b). When considered alone object naming score also emerged as a significant, but slightly less adequate predictor of single word reading [Adjusted $R^2=.21$; $F(1,18)=6.05$, $p<.05$] (Appendix I-3c).

In summary, single word reading was most consistently predicted by PPVT-R verb score, object naming score, and action naming subscores, alone or in combination with one another. For the NR group, single word reading was best predicted by a three-variable model based on action naming "direct object" and "neither cue" scores and object naming performance. For the IR group, the best predictor of single word reading was PPVT-R verb score alone or in combination with action naming "direct object" score. PPVT-R noun score did not emerge as a significant predictor of single word reading for either group. Thus, the regression analyses again partially supported Hypothesis 6d, that verb knowledge better predicts IR reading performance, specifically single word reading, than noun knowledge.

Discussion

Extraction of meaning from written words and retrieval of words which convey precise meaning were thought to be reciprocal processes which depended upon efficiently accessing information from the mental lexicon or semantic memory. The current research was intended to explicate the interrelationships among these processes in normal and reading impaired children, with particular emphasis on the impact of word class on those interrelationships. This entailed comparing normal and impaired readers with respect to reading proficiency, retrieval of specific nouns and verbs from semantic memory, and receptive vocabulary for nouns and verbs.

This section will proceed with a discussion of some of the basic findings that differentiated between normal and impaired readers followed by a more extensive discussion of differences in the predictive relationships among reading, word retrieval, and lexical knowledge for the two groups.

Reading Accuracy and Comprehension

The findings from this study confirmed the hypotheses that children with reading impairments exhibit less accuracy in reading both nouns and verbs, weaker overall performance on a measure combining passage reading

accuracy and speed, and poorer oral reading comprehension than normal readers. Whereas normal readers achieved comparable levels of accuracy and comprehension when reading passages orally, impaired readers exhibited significantly better comprehension than accuracy. This finding is consistent with previous research in which children with reading impairments were found to compensate somewhat for reading deficits by the use of contextual cues (Marshall, 1985; Marshall, 1989; Nicholson, 1991).

As hypothesized, impaired readers exhibited more difficulty in single word reading of verbs than nouns. In addition to supporting informal clinical observations, this finding confirms the superiority of noun over verb reading which had been tentatively suggested in a study of dyslexic boys (Blank & Bruskin, 1984). However, no word class differential in accuracy was observed in either group during oral passage reading. This further suggests impaired readers used contextual cues, in this case to improve verb reading accuracy to a level more consistent with the accuracy of their noun reading. It was noteworthy that, despite the lack of word class differences in passage reading accuracy, only verb reading was significantly positively correlated with other reading measures, including overall passage reading rate/accuracy, overall single word reading, single verb reading in isolation, and oral reading comprehension. These findings

suggest that inaccurate reading of verbs in particular compromises recognition and retention of underlying meaning for reading impaired children, thereby limiting their ability to answer questions about the material. The findings from the present investigation are consistent with previous studies which showed that: a) both nouns and verbs contribute importantly to sentence meaning, but verbs are processed more "deeply," i.e., with more direct evocation of underlying meaning than nouns; and b) verbs contribute more to memory for "gist," whereas nouns aid verbatim recall (Aaronson & Ferres, 1984; Healy & Miller, 1970; Healy & Miller, 1971; Raeburn, 1979; Reynolds & Flagg, 1979).

Expressive and Receptive Language Skills

As predicted, the present investigation identified consistent differences between normal and impaired readers with respect to expressive and receptive language skills. Specifically, impaired readers exhibited less accurate confrontation naming of actions and objects, synonym generation for nouns and verbs, and overall receptive vocabulary than their normal counterparts. In part, the findings of the present study are consistent with previous research which correlated reading deficits with generalized impairments in language skill (Felton, et al., 1987; Liberman, 1985; Murphy, et al., 1988; Rudel, et al.,

1981; Vellutino, 1987; Wolf & Goodglass, 1986). However, the present study investigated, in addition, previously unexplored aspects of word retrieval and knowledge, including action naming and word class differences in receptive vocabulary.

Closer examination of action naming performances revealed more pronounced between-group differences on particular types of items. Specifically, impaired readers exhibited particularly inaccurate action naming, relative to normal readers, on sets of items characterized by the presence of a "customarily associated direct object." This finding suggests that the word retrieval strategies of impaired readers were more vulnerable to distraction by a salient competing object than the strategies used by normal readers. It was hypothesized that naming an action in the presence of a direct object cue demands a more mature word association strategy, i.e., a paradigmatic lexical search among verbs which convey similar information while actively suppressing syntagmatic lexical connections with salient direct object cues.

Nevertheless, an equally plausible alternative explanation of the same phenomenon may be invoked. Once distracted by the salient but less relevant direct object, impaired readers may treat the object as if it were the subject of an implied sentence. Construction of a passive sentence in the form "The [DIRECT OBJECT] is being

[VERBED] by the [SUBJECT]" could facilitate retrieval of the target verb. However, as passive sentences are more syntactically complex and more difficult to construct and to process than active sentences (Slobin, 1979, p. 53-54), children who are less developmentally advanced, such as those with language based developmental reading deficits, may be more likely to construct active than passive implied sentences from the assumed subject. Construction of an active sentence with the direct object cue as subject, in turn, decreases the probability that an impaired reader will retrieve the target verb. For example, focusing on the ladder as the subject in the action naming picture for "climbing," is more likely to elicit from an impaired reader an active sentence construction (e.g., "The ladder is **STANDING** against the wall") than a passive construction (e.g., "The ladder is **BEING CLIMBED** by the boy"). Hence, an incorrect verb (e.g., "standing") may be retrieved. The findings and both alternative explanations are consistent with previous studies which found that poorer readers have difficulty discriminating between relevant and irrelevant contextual cues and suppressing irrelevant information when reading (Merrill, et al., 1981; Gernsbacher, et al., 1990). The existence of such difficulties within the context of both word retrieval and reading activities suggests that impaired readers are characterized by relative weaknesses

in language processing across tasks.

In contrast with expectations that impaired readers have greater difficulty understanding and retrieving verbs than nouns, no significant word class differences were found for either group on any of the expressive or receptive language measures except synonym generation. That task revealed unexpectedly large verb < noun differences among normal readers and nonsignificant correlations between noun and verb retrieval. Those findings suggested a fallibility in the task which was consequently excluded from subsequent analyses. Despite the absence of predicted noun-verb differences, per se, in the other expressive and receptive language measures, when interrelationships among the variables were examined, both between-group and noun-verb differences were revealed. These differences are discussed in greater detail.

Relationships Among Reading, Word Retrieval,

And Receptive Vocabulary

This section begins with a discussion of the predictive relationship between receptive vocabulary and word retrieval followed by a discussion of the predictive relationships among retrieval, word knowledge and reading. Finally, the implications of those findings in terms of

semantic access are discussed.

Noun and Verb Knowledge and Word Retrieval

No previous studies known to the author have examined the role of word-class in receptive vocabulary. Both noun and verb knowledge were significantly more limited in impaired readers than in normal children, confirming a hypothesis of this investigation that impaired readers are characterized by relatively weaker receptive vocabulary. This finding contrasts with previous research findings that receptive vocabulary was relatively well developed in many cases of reading disability (German, 1984; Wolf, 1984; Wolf & Goodglass, 1986). The contrast between this and previous findings may, in part, be attributed to differences in sample selection criteria, including differences in age between this and other samples. Even standardized measures may be differentially sensitive with different age groups. Another possible factor is the sensitivity of the measurement itself. Specifically, in comparison with the traditional emphasis on total number of correct responses, examination of the proportion of correct responses to total items attempted addresses the consistency of accurate responding. Weak or inconsistent ability to access the meaning of orally presented words suggests similar difficulties may exist in ability to extract meaning from written language. It was hypothesized

that such difficulties interfere with impaired readers' abilities to access meaning from reading passages and to recognize "real" words when decoding.

In contrast with expectations that impaired readers would have more significant deficits for verb than noun knowledge, neither group exhibited a consistent advantage for words from one word class over the other. Nevertheless, the two word classes investigated were differentially predictive of word retrieval for the two reading groups. The normal pattern was that receptive knowledge of nouns better predicted action and object naming, but neither verb nor noun knowledge reliably predicted synonym generation performance. The pattern for impaired readers, in contrast, was that receptive knowledge of verbs was the more significant predictor of action and object naming and synonym generation for nouns and verbs. Thus, receptive noun knowledge plays a less significant role than verb knowledge for impaired readers; whereas, deficits in receptive vocabulary for verbs make impaired readers particularly vulnerable to difficulties accessing information from semantic memory. This further suggests that the normative process does not prevail, even to a lesser extent, among the impaired readers. Impaired readers are not simply less skilled normal readers.

Noun and Verb Measures and Reading Performance

A consistent pattern emerged within each group with respect to the best predictors of reading performance. For normal readers, performances on object naming, action naming - direct object present, and action naming - neither cue present stimuli emerged as the most reliable predictors of oral reading comprehension, a passage reading rate/accuracy measure, and single word reading. Thus, in general, word retrieval measures emerged as better predictors of reading than receptive vocabulary (verb and noun) knowledge. Among the retrieval measures, neither word class had superior predictive power for the normal readers.

For impaired readers, single variable models involving object naming or receptive verb knowledge consistently emerged as the best predictors of oral reading comprehension and single word reading. Variance in the passage reading rate/accuracy measure was best accounted for by a two-variable regression equation with receptive verb knowledge and action naming - direct object cue present as independent variables. Nevertheless, single-variable models with object naming or verb knowledge score as independent variable were each as statistically significant a predictor of passage reading rate/accuracy as the two-variable model.

In summary, as in previous research in which object

naming performance was found to be a predictor of reading ability (Wolf, 1984; Wolf & Goodglass, 1986), the object naming measure used in the present research also emerged as a significant predictor of reading comprehension and accuracy, but it was not the only reliable predictor of reading performance for either normal or impaired readers.

Implications Regarding Semantic Access

Taken together, these findings lend support to the hypothesis that correlations between reading and retrieval measures reflect the relative efficiency or inefficiency with which information is accessed in the mental lexicon or semantic memory. Thus, the relatively weaker performances of impaired readers on measures of reading and word retrieval may be construed as evidence that their access to semantic information is less efficient than that of normal readers.

Theoretical support for this supposition may be drawn from the similarity between models of confrontation naming and the tri-partite model of written word identification posited by Marshall (1985, 1989). Confrontation naming models propose that retrieval of an object name entails perception of pictured stimulus and either a) matching that percept directly with stored prototypes which are associated with the object's name, or b) comparing features and functions associated with the percept with

stored semantic and functional attributes of known objects. Marshall's model of word identification, similarly, identifies a perceptual stage, that of "early visual analysis," after which word identification is accomplished via three concurrent processes: a) "phonic" processing, which entails segmenting of words into "graphemic" units to which rules for grapheme-phoneme correspondence are applied, and then blending the phonemes to produce a word-name; b) "direct" or holistic recognition of whole words, and c) "lexicosemantic" processing which entails segmenting words into morphemes (prefixes, root words, suffixes), accessing the meaning and function of those morphemes, associating those units of meaning and function with their phonemic representations, and thus, arriving at the articulated target word. The direct and lexicosemantic routes of word identification parallel direct and semantic routes of object identification. Although never explicitly stated, Marshall's model, like models of confrontation naming, implies the existence of a mental lexicon or semantic memory in which written words are organized by, and accessed via, salient visuoperceptual, orthographic, phonemic, morphological, and semantic features.

It has been suggested in this research that difficulties in semantic access may be a function of developmental delays affecting transition from semantic

organization based upon "syntagmatic" associations to organization in which "paradigmatic" associations predominate. Less facility making paradigmatic associations would be expected to compromise reading and naming to the extent that those processes depend upon facility in making associations on the basis of similarity, e.g., to morphological, visuoperceptual, or phonological prototypes stored in semantic memory. Predominant reliance on syntagmatic associations may not only compromise the fluency of reading by slowing association of a perceptual or orthographic stimulus with its name and meaning, but increase the risk of erroneous associations, i.e., those based upon contiguity in time or space, rather than upon similarity of form, function or meaning.

When erroneous associations were made, either by less mature semantic association strategies or by difficulty discriminating between essential and non-essential stimuli, impaired readers in the age group studied in this investigation seemed to be at a significant disadvantage. They appeared not to have sufficiently developed language and reasoning abilities to employ passive sentence construction to facilitate retrieval of a target verb or to use parallel reasoning skills to test out the reciprocity of associations between word and meaning.

The present research provides empirical evidence that

noun and verb knowledge and retrieval contribute differently to reading performances of normal and impaired readers. These findings contrast with the predominant, single-variable, noun-focused models that claim that object naming is the best predictor of reading performance. According to the present findings, noun knowledge predicts both noun and verb naming in normal readers. Noun and verb naming, in combination, best predict normal reading performance. In contrast, for impaired readers, verb knowledge is the more important predictor of word retrieval. Moreover, reading performance is as effectively, or more effectively, predicted by impaired readers' verb knowledge than by their object naming performance.

These findings emphasize two important points. First, impaired readers are not simply less proficient normal readers. Different patterns characterize the performances of impaired and normal readers on reading and retrieval measures. In contrast with normal readers who read nouns and verbs with comparable accuracy, impaired readers have particular difficulty reading verbs. When confronted with complex or distracting stimuli, impaired readers exhibit less accurate verb retrieval than normal peers. Second, noun and verb knowledge and retrieval are non-redundant measures. Verb knowledge and action naming play as important a role as object naming, and a more important

role than noun knowledge in the prediction of reading accuracy and comprehension for both impaired and normal readers.

Limitations of the Current Research and
Suggestions for Future Research

This investigation represents an initial exploration of the role of word class in the relationships among reading, word retrieval, and receptive vocabulary. As such, its findings are preliminary and cannot yet be confidently generalized to other samples and assessment techniques.

Further work in this area may include refinement of the action naming stimuli to include a larger proportion of "direct object" and "neither cue" items, and introduction of a less subjective technique for identifying such items. Increasing the focus on the two action naming conditions which appeared to most consistently predict reading performance may contribute to more confident interpretation of between-group differences in action naming and may reveal within group differences which were only apparent under less stringent post hoc testing in the current study. Expansion of the normal and reading impaired samples to include 7- to 8-year-olds and 12- to 13-year-olds may yield further information about

the impact of development on lexical retrieval strategies. Moreover, introduction of a second control group comprised of younger normal readers, a strategy which has gained favor in recent research, may help to control for the effects of reading grade level on exposure to reading content and vocabulary, and may help define the impact of developmental delay on between group differences observed in the current research.

These findings suggested that other variables, such as "direct object" and "neither cue" scores on the action naming test and the receptive verb knowledge score, have predictive value in cross sectional research. To provide comparison with literature which has claimed object naming as the best predictor of future reading performance (e.g., Wolf, 1984; Wolf & Goodglass, 1986), future research might compare the longitudinal predictive power of object naming and specifically characterized verb naming conditions.

APPENDICES

- Appendix A: List of Action Naming Referents
Copies of Action Naming Stimuli**
- Appendix B: List of Object Naming Referents**
- Appendix C: Representative Sample of Action Naming
Stimuli From Each "Cuing" Condition**
- Appendix D: Synonym Generation Target Words**
- Appendix E: Single Word Reading Lists**
- Appendices F-I: Multiple Regression Results**
- Appendix F: Relationship Between Word Knowledge
and Retrieval**
 - Appendix G: Relationship Between Word Knowledge/
Retrieval and GORT-R Comprehension**
 - Appendix H: Relationship Between Word Knowledge/
Retrieval and GORT-R Passage Score**
 - Appendix I: Relationship Between Word Knowledge/
Retrieval and Single Word Reading**

APPENDIX A:
LIST OF ACTION NAMING REFERENTS
COPIES OF ACTION NAMING STIMULI¹

Action Naming Referents

Example A: Writing
 Example B: Driving

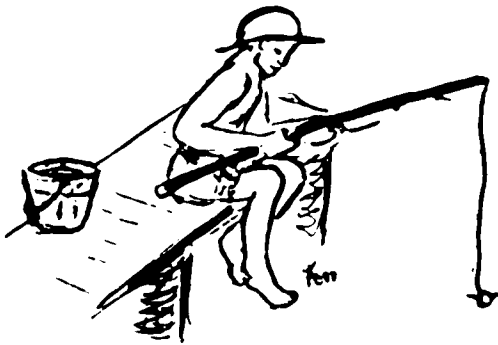
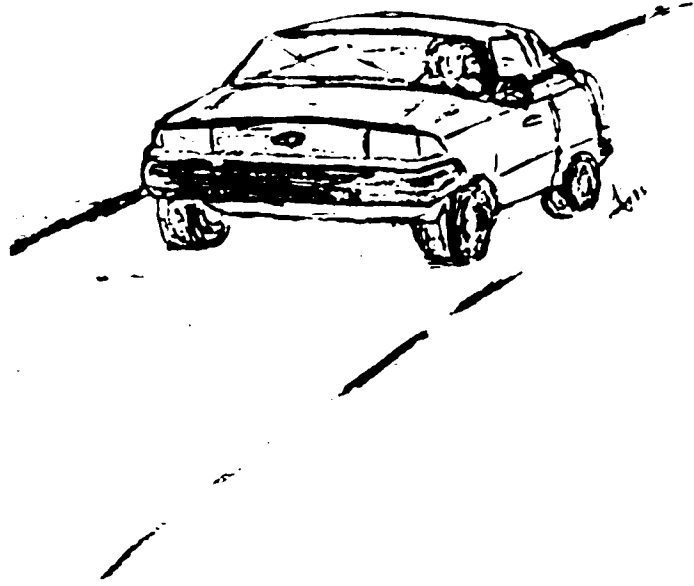
Example C: Fishing
 Example D: Shaving

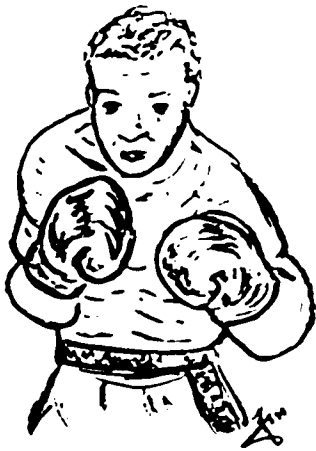
- | | |
|------------------------------|-----------------------------------------|
| 1. Watering ^B | 19. Canoeing/Paddling |
| 2. Climbing ^D | 20. Surfing ^S |
| 3. Boxing ^S | 21. Signaling/Flagging |
| 4. Skiing | 22. Dancing |
| 5. Sailing ^B | 23. Conducting ^D |
| 6. Swinging ^S | 24. Pouring ^D |
| 7. Mowing ^B | 25. Sculpt(ur)'g/Chiseling ^S |
| 8. Kissing ^N | 26. Whispering ^N |
| 9. Digging | 27. Protesting ^N |
| 10. Raking ^B | 28. Weighing ^N |
| 11. Rowing ^D | 29. Delivering ^D |
| 12. Crawling ^N | 30. Marching ^N |
| 13. Golfing ^S | 31. Fencing ^N |
| 14. Ironing ^B | 32. Feeding ^D |
| 15. Parachuting ^S | 33. Harpooning ^B |
| 16. Juggling ^D | 34. Combing ^B |
| 17. Saluting | 35. Jousting |
| 18. Diving ^S | |

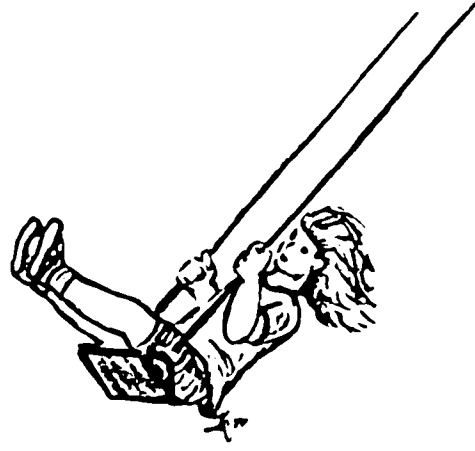
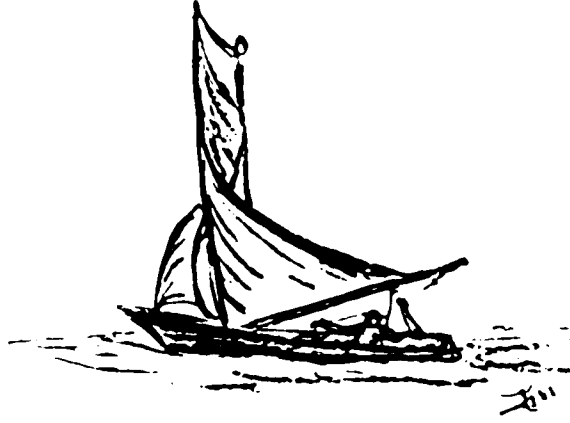
¹ Copies of stimuli are reduced to 48% of original size

KEY TO ACTION NAMING "CUING" CONDITIONS:

- ^S Similarly-named Object Present
^D Direct Object Present
^B Both Cues Present
^N Neither Cue Present

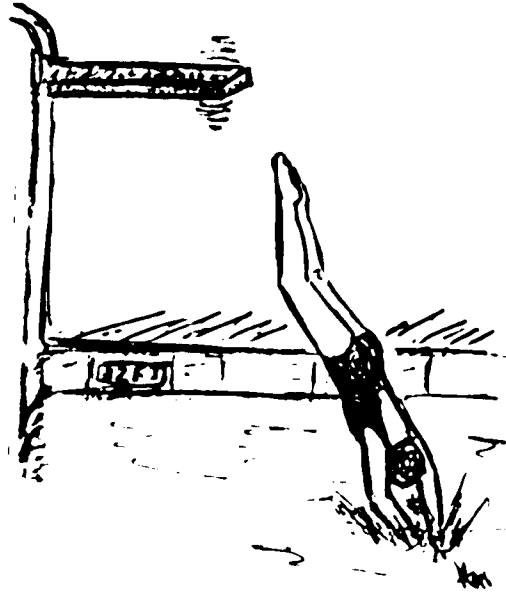




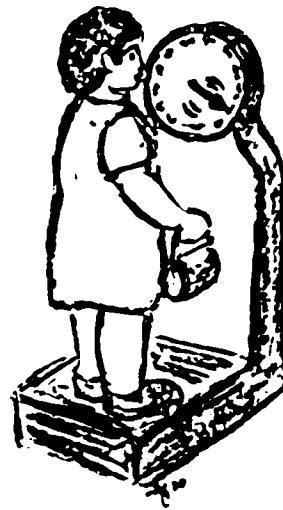
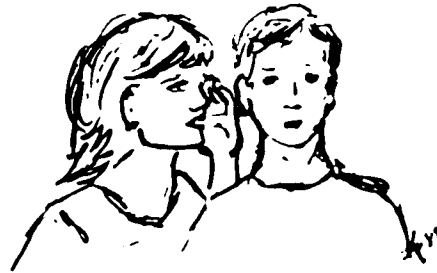


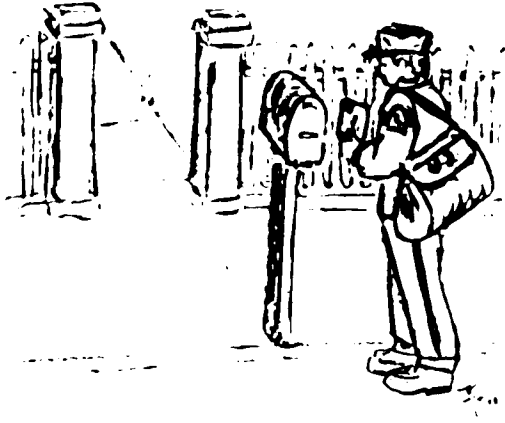


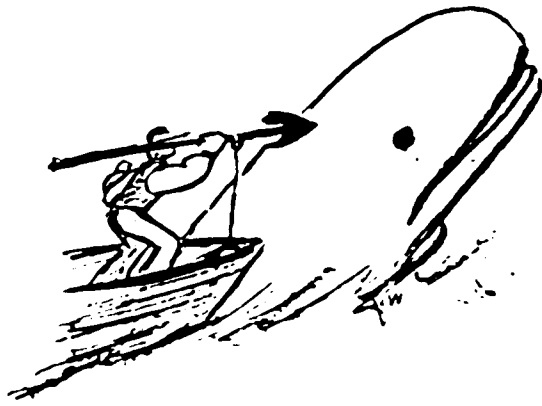












APPENDIX B:
LIST OF OBJECT NAMING REFERENTS

Object Naming Referents

Example A: Bed
Example B: Tree
Example C: Pencil
Example D: House

1. Seahorse
2. Whistle
3. Canoe
4. Scissors
5. Dominces
6. Flower
7. Escalator
8. Toothbrush
9. Beaver
10. Helicopter
11. Harp
12. Broom
13. Pyramid
14. Mushroom
15. Muzzle
16. Wheelchair
17. Funnel
18. Mask
19. Accordion
20. Pretzel
21. Compass
22. Bench
23. Scroll
24. Octopus
25. Sphinx
26. Hanger
27. Rings
28. Racquet
29. Tripod
30. Snail
31. Noose
32. Wreath
33. Palette
34. Unicorn
35. Protractor

APPENDIX C:
REPRESENTATIVE SAMPLE OF ACTION NAMING STIMULI
FROM THE FOUR CUING CONDITIONS

1. Similarly-Named Object Cue Present

- a. Swinging
- b. Diving

2. Direct Object Cue Present

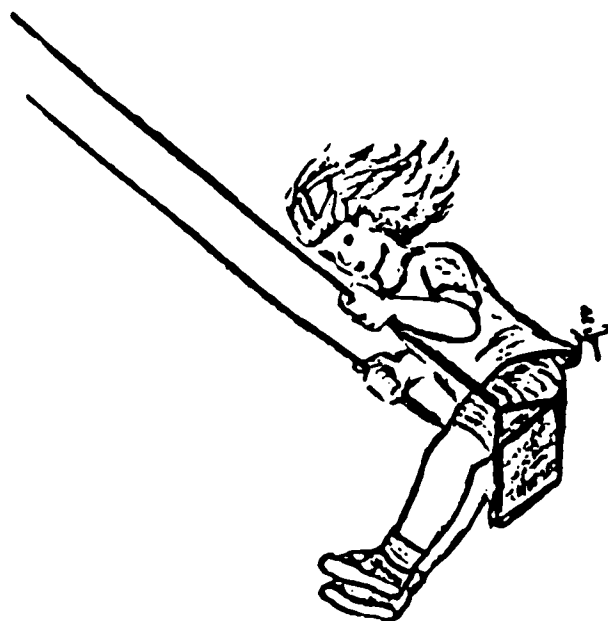
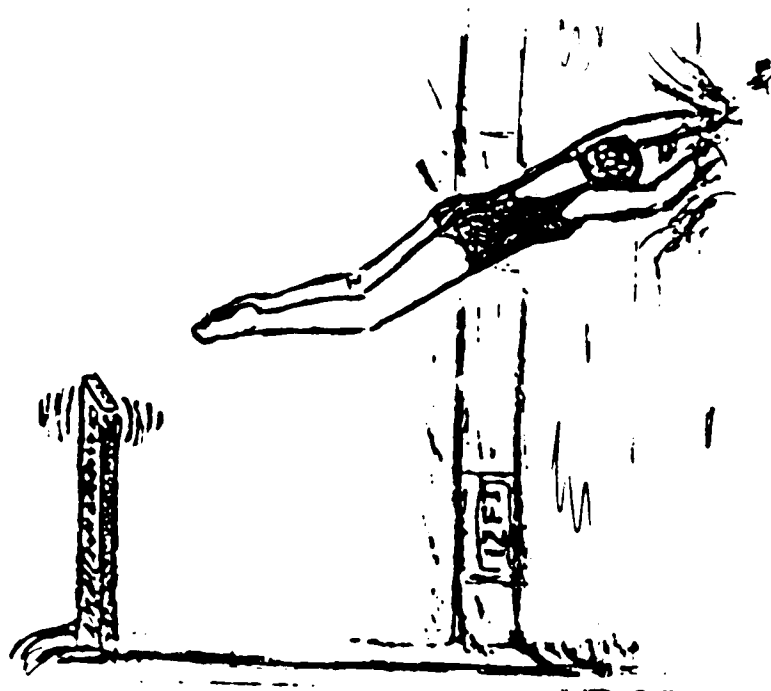
- a. Climbing
- b. Delivering

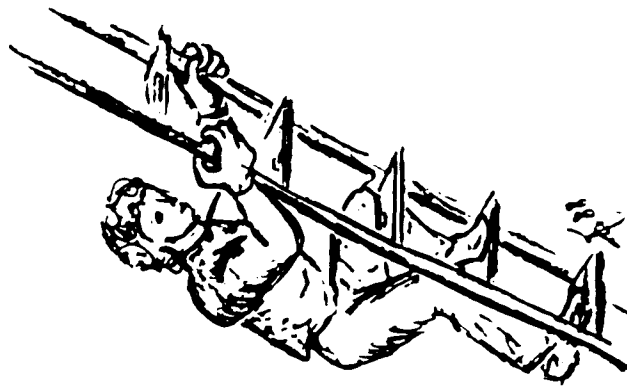
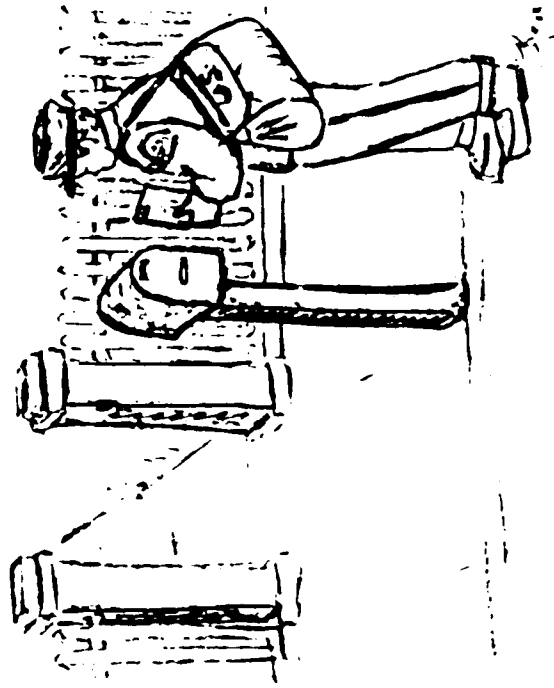
3. Both Cues Present

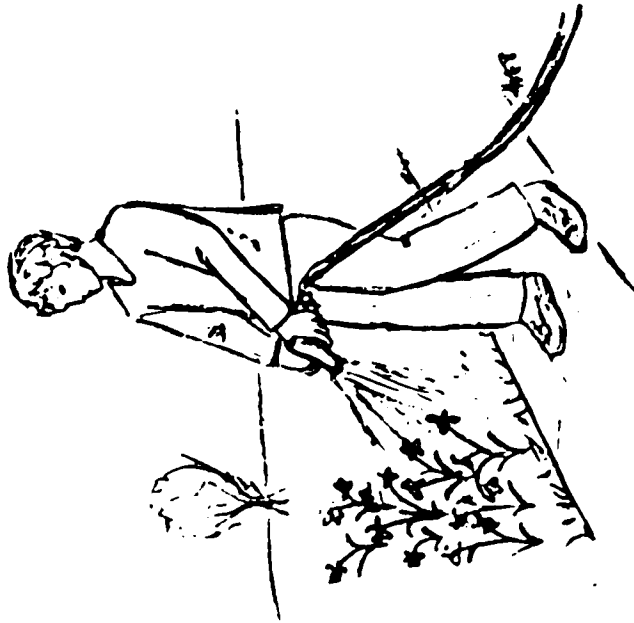
- a. Watering
- b. Raking

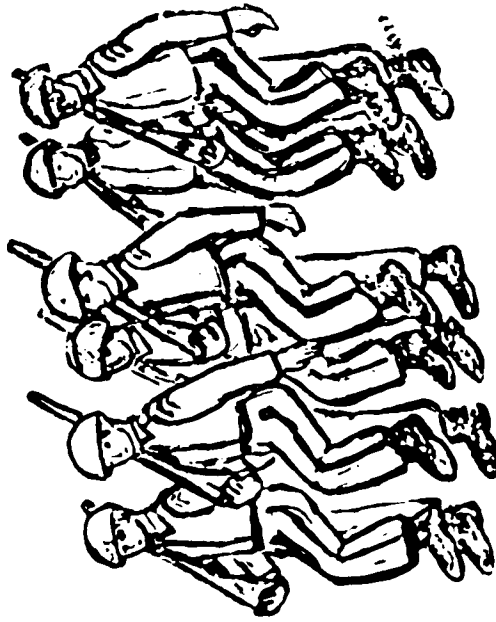
4. Neither Cue Present

- a. Whispering
- b. Marching









APPENDIX D:
SYNONYM GENERATION TARGET WORDS

Verb Targets

1. Washing
2. Signaling
3. Demonstrating
4. Hammering
5. Conducting
6. Massaging

Noun Targets

1. Canoe
2. Pelican
3. Tripod
4. Latch
5. Igloo
6. Acorn

APPENDIX E:
SINGLE WORD READING LISTS

Verb Stimuli

1. got
2. ran
3. built
4. tried
5. happened
6. picked
7. flew
8. placed
9. showed
10. gathered
11. struck
12. cleaning
13. flown
14. raked
15. reached
16. travelled
17. produced
18. prevent
19. picking
20. organized
21. manage
22. concerned
23. delivered
24. derives
25. sought
26. regarded
27. guided
28. ripened
29. announces
30. pelting
31. amplified

Noun Stimuli

1. boys
2. morning
3. girl
4. idea
5. boat
6. lot
7. ears
8. farmer
9. parents
10. pigs
11. bike
12. playground
13. hens
14. limb
15. past
16. cowboy
17. public
18. honey
19. invention
20. riders
21. output
22. keeper
23. appearance
24. site
25. custom
26. relation
27. poverty
28. violence
29. era
30. torrent
31. precautions

APPENDIX F: RELATIONSHIP BETWEEN WORD KNOWLEDGE AND RETRIEVAL
MULTIPLE REGRESSION RESULTS (Forward Regression Analysis)

APPENDICES F-1a AND F-1b:

SAMPLE = NR GROUP (n=20)
DV's = ACTION AND OBJECT NAMING

=====
Appendix F-1a

BEST MODEL:
DV= ACTION NAMING
IV=PPVT-R NOUN SCORE

Adjusted R²= .32; F(1,18)= 9.80, p<.01
Intercept= 14.68

<u>Independent Variable</u>	<u>B</u>	<u>Beta</u>	<u>Std. Error</u> <u>Of Beta</u>	<u>t(18)</u>	<u>p</u>
PPVT-R Noun Score	15.49	.59	.19	3.13	<.01

=====
Appendix F-1b

BEST MODEL:
DV=OBJECT NAMING
IV=PPVT-R NOUN SCORE

Adjusted R²= .40; F(1,18)= 13.77, p<.01
Intercept= 15.74

<u>Independent Variable</u>	<u>B</u>	<u>Beta</u>	<u>Std. Error</u> <u>Of Beta</u>	<u>t(18)</u>	<u>p</u>
PPVT-R Noun Score	14.49	.69	.18	3.71	<.01

APPENDIX F. Continued:
RELATIONSHIP BETWEEN WORD KNOWLEDGE AND RETRIEVAL
MULTIPLE REGRESSION RESULTS (Forward Regression Analysis)

APPENDICES F-2a AND F-2b:

SAMPLE = IR GROUP (n=20)
DV's = ACTION AND OBJECT NAMING

=====
Appendix F-2a

BEST MODEL
DV=ACTION NAMING
IV=PPVT-R NOUN AND VERB SCORES

Adjusted R²= .34; F(2,17)= 5.98, p<.05
Intercept= 3.64

<u>Independent Variable</u>	<u>B</u>	<u>Beta</u>	<u>Std. Error</u> <u>Of Beta</u>	<u>t(17)</u>	<u>p</u>
PPVT-R Verb Score	10.68	.56	.19	2.93	<.01
PPVT-R Noun Score	16.12	.47	.19	2.44	<.05

=====
Appendix F-2b

BEST MODEL
DV=OBJECT NAMING
IV=PPVT-R NOUN AND VERB SCORES

Adjusted R²= .45; F(2,17)= 8.90, p<.01
Intercept= -1.25

<u>Independent Variable</u>	<u>B</u>	<u>Beta</u>	<u>Std. Error</u> <u>Of Beta</u>	<u>t(17)</u>	<u>p</u>
PPVT-R Verb Score	17.29	.70	.17	4.00	<.001
PPVT-R Noun Score	17.27	.38	.17	2.21	<.05

APPENDIX F, Continued:
RELATIONSHIP BETWEEN WORD KNOWLEDGE AND RETRIEVAL
MULTIPLE REGRESSION RESULTS (Forward Regression Analysis)

APPENDIX F-2c AND F-2d

SAMPLE = IR GROUP (n=20)
DV = SYNONYM GENERATION

=====
Appendix F-2c

BEST MODEL
DV=SYNONYM GENERATION - NOUNS
IV=PPVT-R NOUN AND VERB SCORES

Adjusted R²= .58; F(2,17)= 14.38, p<.001
Intercept= -7.48

<u>Independent Variable</u>	<u>B</u>	<u>Beta</u>	<u>Std. Error</u> <u>Of Beta</u>	<u>t(17)</u>	<u>p</u>
PPVT-R Verb Score	6.50	.70	.15	4.59	<.001
PPVT-R Noun Score	9.56	.57	.15	3.73	<.01

=====
=====
Appendix F-2d

BEST MODEL
DV=SYNONYM GENERATION - VERBS
IV=PPVT-R VERB SCORE

Adjusted R²= .31; F(2,17)= 9.55, p<.01
Intercept= -0.41

<u>Independent Variable</u>	<u>B</u>	<u>Beta</u>	<u>Std. Error</u> <u>Of Beta</u>	<u>t(17)</u>	<u>p</u>
PPVT-R Verb Score	4.70	.59	.19	3.09	<.01

=====

**APPENDIX G:
RELATIONSHIP BETWEEN WORD KNOWLEDGE/RETRIEVAL
AND READING COMPREHENSION
MULTIPLE REGRESSION RESULTS (Forward Regression Analysis)**

APPENDICES G-1a THROUGH G-1f

**SAMPLE = COMBINED GROUPS OF IR AND NR (N=40)
DV = GORT-R COMPREHENSION**

=====
Appendix G-1a

**BEST 4-VARIABLE MODEL
IV = OBJECT NAMING SCORE, ACTION NAMING DIRECT OBJECT
AND NEITHER CUE SCORES, PPVT-R VERB SCORE**

Adjusted R²= .52; F(4,35)=11.62, p<.0001
Intercept= 27.24

<u>Independent Variable</u>	<u>B</u>	<u>Beta</u>	<u>Std. Error Of Beta</u>	<u>t(35)</u>	<u>p</u>
Object Naming Score	2.03	.54	.19	2.84	<.01
Direct Object Score ¹	5.01	.37	.14	2.63	<.05
Neither Cue Score ¹	-4.49	-.26	.15	-1.74	.09
PPVT-R Verb Score	25.30	.22	.14	1.55	.13

¹ Direct Object / Neither Cue Scores from Action Naming Task

=====
Appendix G-1b

**BEST 3-VARIABLE MODELS (A)
IV = OBJECT NAMING SCORE, ACTION NAMING DIRECT OBJECT
AND NEITHER CUE SCORES**

Adjusted R²= .50; F(3,36)=14.13, p<.0001
Intercept= 34.73

<u>Independent Variable</u>	<u>B</u>	<u>Beta</u>	<u>Std. Error Of Beta</u>	<u>t(36)</u>	<u>p</u>
Object Naming Score	2.63	.69	.16	4.25	<.001
Direct Object Score ¹	4.10	.30	.14	2.22	<.05
Neither Cue Score ¹	-4.51	-.27	.15	-1.72	.09

¹ Direct Object / Neither Cue Scores from Action Naming Task

=====

APPENDIX G, Continued:
RELATIONSHIP BETWEEN WORD KNOWLEDGE/RETRIEVAL
AND READING COMPREHENSION
MULTIPLE REGRESSION RESULTS (Forward Regression Analysis)
SAMPLE = COMBINED GROUPS OF IR AND NR (N=40)

=====
Appendix G-1c

BEST 3-VARIABLE MODELS (B)
IV = OBJECT NAMING SCORE, ACTION NAMING DIRECT
OBJECT SCORE, PPVT-R VERB SCORE

Adjusted R²= .49; F(3,36)=13.70, p<.0001
Intercept= 23.52

<u>Independent Variable</u>	<u>B</u>	<u>Beta</u>	<u>Std.Error</u> <u>Of Beta</u>	<u>t(36)</u>	<u>p</u>
Object Naming Score	1.43	.38	.17	2.22	<.05
Direct Object Score ¹	4.52	.33	.14	2.33	<.05
PPVT-R Verb Score	25.42	.22	.14	1.52	.13

¹ Direct Object Score from Action Naming Task

=====
Appendix G-1d

BEST 2-VARIABLE MODELS (A)
IV = OBJECT NAMING SCORE, ACTION NAMING DIRECT OBJECT SCORE

Adjusted R²= .48; F(3,37)=18.75, p<.0001
Intercept= 31.03

<u>Independent Variable</u>	<u>B</u>	<u>Beta</u>	<u>Std.Error</u> <u>Of Beta</u>	<u>t(37)</u>	<u>p</u>
Object Naming Score	2.02	.53	.14	3.89	<.001
Direct Object Score ¹	3.60	.26	.14	1.93	.06

¹ Direct Object Score from Action Naming Task

APPENDIX G, Continued:
RELATIONSHIP BETWEEN WORD KNOWLEDGE/RETRIEVAL
AND READING COMPREHENSION
MULTIPLE REGRESSION RESULTS (Forward Regression Analysis)
SAMPLE = COMBINED GROUPS OF IR AND NR (N=40)

=====
 Appendix G-1e

BEST 2-VARIABLE MODELS (B)
 IV = ACTION NAMING DIRECT OBJECT SCORE, PPVT-R VERB SCORE

Adjusted R²= .44; F(2,37)=16.35, p<.0001
 Intercept= 30.55

<u>Independent Variable</u>	<u>B</u>	<u>Beta</u>	<u>Std. Error</u> <u>Of Beta</u>	<u>t(37)</u>	<u>p</u>
Direct Object Score ¹	7.07	.52	.12	4.31	<.001
PPVT-R Verb Score	48.04	.41	.12	3.43	<.01

¹ Direct Object Score from ActAction Naming Task

=====
 Appendix G-1f

BEST 1-VARIABLE MODEL
 IV = OBJECT NAMING SCORE

Adjusted R²= .44; F(1 38)=31.54, p<.0001
 Intercept= 27.24

<u>Independent Variable</u>	<u>B</u>	<u>Beta</u>	<u>Std. Error</u> <u>Of Beta</u>	<u>t(38)</u>	<u>p</u>
Object Naming Score	2.55	.67	.12	5.61	<.001

APPENDIX G, Continued:
RELATIONSHIP BETWEEN WORD KNOWLEDGE/RETRIEVAL
AND GORT-R COMPREHENSION
MULTIPLE REGRESSION RESULTS (Forward Regression Analysis)
SAMPLE = NR GROUP (n=20)

APPENDIX G-2

SAMPLE = NR GROUP (N=20)
DV = GORT-R COMPREHENSION

=====
 Appendix G-2

BEST MODEL

IV = OBJECT NAMING SCORE, ACTION NAMING DIRECT OBJECT
AND NEITHER CUE SCORES

Adjusted R²= .31; F(3,16)= 3.91, p<.05
 Intercept= 36.23

<u>Independent Variable</u>	<u>B</u>	<u>Beta</u>	<u>Std. Error</u> <u>Of Beta</u>	<u>t(16)</u>	<u>p</u>
Direct Object Score ¹	7.08	.57	.25	2.30	<.05
Object Naming Score	3.11	.55	.24	2.28	<.05
Neither Cue Score ¹	-10.54	-.53	.29	-1.83	.09

¹ Direct Object / Neither Cue Scores from Action Naming Task

=====

APPENDIX G, Continued:
RELATIONSHIP BETWEEN WORD KNOWLEDGE/RETRIEVAL
AND GORT-R COMPREHENSION
MULTIPLE REGRESSION RESULTS (Forward Regression Analysis)
SAMPLE = IR GROUP (n=20)

APPENDICES G-3a AND G-3b

SAMPLE = IR GROUP (N=20)
DV = GORT-R COMPREHENSION

=====
Appendix G-3a

BEST MODEL (A)
IV = OBJECT NAMING SCORE

Adjusted R²= .27; F(1,18)= 8.01, p<.05
Intercept= 51.81

<u>Independent Variable</u>	<u>B</u>	<u>Beta</u>	<u>Std. Error</u> <u>Of Beta</u>	<u>t(18)</u>	<u>p</u>
Object Naming Score	1.65	.55	.20	2.83	<.05

=====

=====
Appendix G-3b

BEST MODEL (B)
IV = PPVT-R VERB SCORE

Adjusted R²= .16; F(1,18)= 4.58, p<.05
Intercept= 66.02

<u>Independent Variable</u>	<u>B</u>	<u>Beta</u>	<u>Std. Error</u> <u>Of Beta</u>	<u>t(18)</u>	<u>p</u>
PPVT-R Verb Score	33.36	.45	.21	2.14	<.05

=====

**APPENDIX H:
 RELATIONSHIP BETWEEN WORD KNOWLEDGE/RETRIEVAL
 AND GORT-R PASSAGE SCORE
 MULTIPLE REGRESSION RESULTS (Forward Regression Analysis)**

APPENDIX H-1

**SAMPLE = COMBINED GROUPS OF IR AND NR (N=40)
 DV = GORT-R PASSAGE SCORE**

=====
 Appendix H-1

**BEST 4-VARIABLE MODEL
 IV = OBJECT NAMING SCORE, ACTION NAMING DIRECT OBJECT
 AND NEITHER CUE SCORES, PPVT-R VERB SCORE**

Adjusted R² = .68; F(4,35)=21.43, p<.0001
 Intercept = -10.14

<u>Independent Variable</u>	<u>B</u>	<u>Beta</u>	<u>Std. Error Of Beta</u>	<u>t(35)</u>	<u>p</u>
Direct Object Score ¹	9.61	.53	.11	4.65	<.001
PPVT-R Verb Score	60.38	.39	.11	3.41	<.01
Object Naming Score	1.93	.39	.16	2.48	<.05
Neither Cue Score ¹	-6.75	-.30	.12	-2.41	<.05

¹ Direct Object / Neither Cue Scores from Action Naming Task

=====

APPENDIX H. Continued:
RELATIONSHIP BETWEEN WORD KNOWLEDGE/RETRIEVAL
AND GORT-R PASSAGE SCORE
MULTIPLE REGRESSION RESULTS (Forward Regression Analysis)

APPENDIX H-2:

SAMPLE = NR GROUP (n=20)
DV = GORT-R PASSAGE SCORE

=====
Appendix H-2

BEST MODEL

IV = OBJECT NAMING SCORE, ACTION NAMING DIRECT OBJECT
AND NEITHER CUE SCORES

Adjusted R²= .61; F(3,16)= 10.77, p<.001
Intercept= 54.37

<u>Independent Variable</u>	<u>B</u>	<u>Beta</u>	<u>Std. Error</u> <u>Of Beta</u>	<u>t(16)</u>	<u>p</u>
Direct Object Sc	1.95	.95	.19	5.02	<.001
Neither Cue Sc		-.82	.22	-3.74	<.01
Object Naming Sc	.59	.45	.18	2.47	<.05

¹ Direct Object / Neither Cue Scores from Action Naming Task

=====

APPENDIX H, Continued:
 RELATIONSHIP BETWEEN WORD KNOWLEDGE/RETRIEVAL
 AND GORT-R PASSAGE SCORE
 MULTIPLE REGRESSION RESULTS (Forward Regression Analysis)

APPENDICES H-3a THROUGH H-3c:
 SAMPLE = IR GROUP (n=20)
 DV = GORT-R PASSAGE SCORE

=====
 Appendix H-3a

BEST 2-VARIABLE MODEL:
 IV = PPVT-R VERB SCORE, ACTION NAMING DIRECT OBJECT SCORE

Adjusted R² = .32; F(2,17) = 5.46, p < .05
 Intercept = 0.79

<u>Independent Variable</u>	<u>B</u>	<u>Beta</u>	<u>Std. Error Of Beta</u>	<u>t(17)</u>	<u>p</u>
PPVT-R Verb Score	66.56	.67	.21	3.25	<.01
Direct Object Score ¹	8.46	.39	.21	1.89	.08

¹ Direct Object Score from Action Naming Task

=====
 Appendix H-3b

BEST 1-VARIABLE MODEL (A)
 IV = OBJECT NAMING SCORE

Adjusted R² = .23; F(1,18) = 6.79, p < .05
 Intercept = 32.77

<u>Independent Variable</u>	<u>B</u>	<u>Beta</u>	<u>Std. Error Of Beta</u>	<u>t(18)</u>	<u>p</u>
Object Naming Score	2.08	.52	.20	2.61	<.05

=====
 Appendix H-3c

BEST 1-VARIABLE MODEL (B)
 IV = PPVT-R VERB SCORE

Adjusted R² = .22; F(1,18) = 6.44, p < .05
 Intercept = 44.97

<u>Independent Variable</u>	<u>B</u>	<u>Beta</u>	<u>Std. Error Of Beta</u>	<u>t(18)</u>	<u>p</u>
PPVT-R Verb Score	50.71	.51	.20	2.54	<.05

=====

**APPENDIX I:
RELATIONSHIP BETWEEN WORD KNOWLEDGE/RETRIEVAL
AND SINGLE WORD READING SCORE
MULTIPLE REGRESSION RESULTS (Forward Regression Analysis)**

APPENDICES I-1a THROUGH I-1d

**SAMPLE = COMBINED GROUPS OF IR AND NR (N=40)
DV = SINGLE WORD READING SCORE**

=====
Appendix I-1a

**BEST 4-VARIABLE MODEL
IV = OBJECT NAMING SCORE, ACTION NAMING DIRECT OBJECT
AND NEITHER CUE SCORES, PPVT-R VERB SCORE**

Adjusted R²= .61; F(4,35)= 16.35, p<.0001
Intercept= -0.64

<u>Independent Variable</u>	<u>B</u>	<u>Beta</u>	<u>Std. Error Of Beta</u>	<u>t(35)</u>	<u>p</u>
Object Naming Score	0.03	.50	.17	2.96	<.01
PPVT-R Verb Score	0.82	.40	.13	3.15	<.01
Direct Object Score ¹	0.07	.31	.13	2.45	<.05
Neither Cue Score ¹	-0.08	-.27	.14	-1.95	.06

¹ Direct Object / Neither Cue Scores from Action Naming Task

=====
Appendix I-1b

**BEST 3-VARIABLE MODEL
IV = OBJECT NAMING SCORE, ACTION NAMING DIRECT OBJECT SCORE,
PPVT-R VERB SCORE**

Adjusted R²= .58; F(3,36)= 19.06, p<.0001
Intercept= -0.71

<u>Independent Variable</u>	<u>B</u>	<u>Beta</u>	<u>Std. Error Of Beta</u>	<u>t(36)</u>	<u>p</u>
PPVT-R Verb Score	0.82	.40	.13	3.04	<.01
Object Naming Score	0.02	.34	.15	2.22	<.05
Direct Object Score ¹	0.07	.27	.13	2.10	<.05

¹ Direct Object Score from Action Naming Task

=====

APPENDIX I. Continued:
RELATIONSHIP BETWEEN WORD KNOWLEDGE/RETRIEVAL
AND SINGLE WORD READING SCORE
MULTIPLE REGRESSION RESULTS (Forward Regression Analysis)

APPENDICES I-la THROUGH I-ld. Continued:
SAMPLE = COMBINED GROUPS OF IR AND NR (N=40)
DV = SINGLE WORD READING

=====
 Appendix I-lc

BEST 2-VARIABLE MODELS (A)
 IV = OBJECT NAMING SCORE, PPVT-R VERB SCORE

Adjusted R²= .54; F(2,37)= 24.13, p<.0001
 Intercept= -0.59

<u>Independent Variable</u>	<u>B</u>	<u>Beta</u>	<u>Std. Error</u> <u>Of Beta</u>	<u>t(36)</u>	<u>p</u>
Object Naming Score	0.04	.53	.13	4.11	<.001
PPVT-R Verb Score	0.64	.31	.13	2.40	<.05

=====
 Appendix I-ld

BEST 2-VARIABLE MODELS (B)
 IV = ACTION NAMING DIRECT OBJECT SCORE, PPVT-R VERB SCORE

Adjusted R²= .54; F(2,37)= 23.63, p<.0001
 Intercept= -0.60

<u>Independent Variable</u>	<u>B</u>	<u>Beta</u>	<u>Std. Error</u> <u>Of Beta</u>	<u>t(36)</u>	<u>p</u>
PPVT-R Verb Score	1.18	.57	.13	5.25	<.001
Direct Object Score ¹	0.11	.44	.13	4.03	<.001

¹ Direct Object Score from Action Naming Task

=====

APPENDIX I. Continued:
RELATIONSHIP BETWEEN WORD KNOWLEDGE/RETRIEVAL
AND SINGLE WORD READING SCORE
MULTIPLE REGRESSION RESULTS (Forward Regression Analysis)

APPENDIX I-2

SAMPLE = NR GROUP (N=20)
DV = SINGLE WORD READING SCORE

=====
Appendix I-2

BEST MODEL

IV = OBJECT NAMING SCORE, ACTION NAMING DIRECT OBJECT
AND NEITHER CUE SCORES

Adjusted R²= .30; F(3,16)= 3.69, p<.05
Intercept= .47

<u>Independent Variable</u>	<u>B</u>	<u>Beta</u>	<u>Std. Error</u> <u>Of Beta</u>	<u>t(16)</u>	<u>p</u>
Neither Cue Score	-.09	-.66	.29	-2.24	<.05
Object Naming Score	0.02	.61	.24	2.49	<.05
Direct Object Score ¹	0.05	.53	.25	2.11	.05

¹ Direct Object / Neither Cue Scores from Action Naming Task

=====

APPENDIX I, Continued:
RELATIONSHIP BETWEEN WORD KNOWLEDGE/RETRIEVAL
AND SINGLE WORD READING SCORE
MULTIPLE REGRESSION RESULTS (Forward Regression Analysis)

APPENDICES I-3a THROUGH I-3c

SAMPLE = IR GROUP (N=20)
DV = SINGLE WORD READING SCORE

=====
 Appendix I-3a

BEST 2-VARIABLE MODEL
 IV = ACTION NAMING DIRECT OBJECT SCORE, PPVT-R VERB SCORE

Adjusted R²= .40; F(2,17)= 7.31, p<.01
 Intercept= -0.58

<u>Independent Variable</u>	<u>B</u>	<u>Beta</u>	<u>Std. Error</u> <u>Of Beta</u>	<u>t(17)</u>	<u>p</u>
PPVT-R Verb Score	1.14	.74	.19	3.82	<.01
Direct Object Score ¹	0.09	.27	.19	1.37	.19

¹ Direct Object / Neither Cue Scores from Action Naming Task

=====
 Appendix I-3b

BEST 1-VARIABLE MODELS (A)
 IV = PPVT-R VERB SCORE

Adjusted R²= .37; F(1,18)= 12.17, p<.01
 Intercept= -0.12

<u>Independent Variable</u>	<u>B</u>	<u>Beta</u>	<u>Std. Error</u> <u>Of Beta</u>	<u>t(18)</u>	<u>p</u>
PPVT-R Verb Score	0.97	.64	.18	3.49	<.01

=====
 Appendix I-3c

BEST 1-VARIABLE MODELS (B)
 IV = OBJECT NAMING SCORE

Adjusted R²= .21; F(1,18)= 6.05, p<.05
 Intercept= -0.15

<u>Independent Variable</u>	<u>B</u>	<u>Beta</u>	<u>Std. Error</u> <u>Of Beta</u>	<u>t(18)</u>	<u>p</u>
Object Naming Score	0.03	.50	.20	2.46	<.05

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