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SENTENCE COMPREHENSION LIMITATIONS RELATED TO SYNTACTIC DEFICITS IN READING DISABLED CHILDREN

by

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Abstract

SENTENCE COMPREHENSION LIMITATIONS RELATED TO SYNTACTIC DEFICITS IN READING DISABLED CHILDREN

by

Cecile L. Stein

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This study was based on the premises that underlying reading disabilities is a language disorder. Twenty reading disabled subjects (ten seven/eight year olds and ten nine/ten year olds) were compared with twenty average readers of the same age levels.

Three language tasks were administered auditorily and in written form; concrete operationality was also tested. A sentence comprehension task was administered in which subjects were required to act out sentences using toy animals and objects. The stimulus sentence types included simple active declaratives, passive, and multiple clause sentences with an unspecified noun phrase.

Based on the premise that child language is constrained by linguistic universals, patterns of structural analysis and the emergence of the C-Command Constraint on Control were determined based on guidelines established by Hsu (1981). The classificatory grammar types which were

identified by Hsu were: subject oriented; object oriented; object oriented with evidence of C-Command; mixed subject-object grammar and adult grammar.

Two types of metalinguistic tasks were administered to look at the children's ability to make grammatical judgments. One was a synonomy task wherein subjects were asked to judge the same types of sentences as appeared in the comprehension task. The other task was a well-formedness judgment task of sentences containing structural violations of content and function word items. A linear correlation coefficient was obtained on the well-formedness and conservation task to determine if the two abilities were related.

The hypotheses were that: Reading disabled subjects would evince similar performance on the comprehension task, regardless of modality of presentation, would have more difficulty on complex sentences than skilled readers, would exhibit less mature levels of grammatical orientation and lower C-Command levels, and would perform more poorly on the metalinguistic and the conservation task.

The prediction of similar performance regardless of modality was supported. However, subjects who had difficulty reading were given assistance, which means that the reading portion was not totally a measure of the subject's own

reading ability. The results of similarity of performance regarding modality must, therefore, be cautiously stated.

The hypothesis that reading disabled subjects would have more difficulty on the sentence comprehension task was supported. The reading disabled group did as well as the controls on the simple active declarative and passive sentences, but had more difficulty on the multiple clause sentences.

The reading disabled group demonstrated more mixed patterns of grammatical orientation and lower C-Command levels. Within the reading impaired mixed group, subjects exhibited varying levels of C-Command. The control subjects all had reliably high C-Command scores.

The patterns exhibited by the reading impaired group suggest not only a delay in grammatical development but a difference as well.

The reading disabled groups showed varying patterns on the two metalinguistic tasks. The younger experimental group performed more poorly than did the controls on the synonomy task with reference to the passive sentences. The older groups did not demonstrate a significant difference in synonomy judgment scores for the passives.

Results of the well-formedness task indicated that reading disabled subjects demonstrated poorer judgment in particular, for function word violations.

The younger reading impaired group performed more poorly on the conservation task; no significant difference was found between the older groups. Well-formedness and conservation scores appeared correlated in the older experimental and younger control groups only.

It was concluded that reading disabled children evince a language delay as well as a difference. Classification according to grammatical orientation and C-Command appears to be a sensitive measure of language development.

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In memory of my late father

Mr. Alexander Gross

He would have been happy.

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CHAPTER I

INTRODUCTION AND HISTORY

Introduction

Research in the area of learning disabilities has sought to explain why some children have difficulty learning to read. Theories of reading impairment have characterized the disorder in a variety of ways. Such theories have claimed that these children have visual perceptual deficiencies, visual short-term memory deficits, auditory short-term memory deficits, attentional deficits, lack of intersensory integration, and poor sequential and temporal order recall.

Recent research, however, suggests that reading impaired children may evince poorer performance than skilled readers in the above mentioned areas "due to a paucity or inaccessibility of various types of verbal information -- information that would otherwise aid performance on multidimensional tasks by virtue of its coding function" (Vellutino, 1980). Therefore, there is growing support for a theory that reading impaired children may be deficient in one or more of the

various aspects of language: phonology, syntax, and semantics. It is upon an hypothesized syntactic deficit that this study focuses in response to the assertion that language, as well as metalinguistic ability, are requirements for the development of reading skills (Vellutino, 1980).

If reading disabled children do exhibit syntactic comprehension deficits as well as metalinguistic deficits, then of what consequence is this to the reading impaired child?

To answer this question, a model of language processing which views language comprehension, whether it is through listening or reading, as a system composed of relatively autonomous processing levels will be cited (Forster, 1979). Based upon this conceptual framework, a deficit in the ability to use the syntax of the sentence for interpretive purposes may result in a compensatory reliance upon semantic and conceptual information as well as upon other non-syntactic, less precise alternatives to interpret sentences. Syntax specifies precisely the sentence's grammatical relations, time and location. Through rearrangement, and deletion of its elements as well as through combination with additional clauses, the sentence increases in complexity. Sentence syntax provides a framework which is further enhanced by semantic and conceptual knowledge.

In addition, metalinguistic awareness implies knowledge of and the ability to think about the structure of the language. In fact, it has been argued that reading is essentially a metalinguistic task because the reader is required to "stand back" and analyze written language (Menyuk and Flood, 1981).

If, as has been suggested, skilled reading is dependent upon intact language and metalinguistic abilities, and if the reading disabled child comes to the reading situation with deficient syntactic comprehension skills, then it may be reasonable to suggest that the means used to interpret a spoken sentence will be applied to the interpretation of a written sentence.

Recent research in normally developing children, which will be reviewed, has attempted to correlate non-linguistic cognitive and, variously, syntactic and metalinguistic development. If reading disabled children are deficient in metalinguistic abilities, will they also be deficient in cognitive development? This question is raised in light of the theory that the mental processes which underlie the ability to make metalinguistic judgments may be those which are related to aspects of cognitive development.

The plan of this study was to:

1. Examine how children with reading disability understand spoken and written sentences;

2. Classify the patterns of sentence interpretation according to a system of previously established guidelines for characterizing linguistic development;
3. Test for the development of metalinguistic abilities;
4. Test for levels of concrete operational thought and determine whether a relationship exists between cognitive and metalinguistic abilities.

The following is a review of the pertinent literature regarding syntactic, metalinguistic and cognitive abilities in the normative and reading disabled populations.

History

Sentence Comprehension

Various researchers have asserted that prior to the full emergence of syntactic competence, young children use comprehension strategies to interpret sentences. One such strategy is word order. Bever (1970) conceives of this strategy as the correspondence of "the N-V-N sequence...in the mind of the child to actor-action-object." Furthermore, Slobin (1971) states that sentences deviating from standard word order are integrated at early stages of development as if they were examples of standard word order. For example, de Villiers and de Villiers (1974) found that children

younger than age four did not understand passive sentences. They interpreted the first noun as the sentence of the subject and the second noun as the object. Consequently, a sentence as

The car was hit by the truck

was interpreted as

The car hit the truck.

Therefore, in the early stages of language development, children's comprehension of language can be described in terms of their cognitive-perceptual operations.

Hakes (1980) suggests that children in the course of their language development continue to build interpretive strategies. Consequently, whereas a child of four might interpret sentences using an "order" strategy, when s/he is seven or eight years of age, the available interpretive options have increased to include syntactic comprehension. The major differences between the two age groups are the increase in alternatives to interpret sentences and the ability to use these different alternatives.

Research of childrens' comprehension of passive and complex sentences has provided information regarding their ability to interpret these sentences as well as providing a framework to identify levels of normal syntactic comprehension development.

Research of the passive construction indicates that the use of lexical knowledge and reality can be sufficient for comprehending non-reversible passives and truncated passives, but according to Sinclair, Sinclair and de Marcellus (1971) complete knowledge of the passive, i.e. reversible passives, is possible by age seven. Beilin and Spontak (1969) assert that the period between ages five and seven is a critical period for the development of the passive voice.

Other studies using English and German speaking children (Caprez, Sinclair and Studer, 1971) resulted in similar findings. Evidence suggested a process of comprehension of the passive which begins at least by age three and is not complete until age seven.

Ferreiro and Sinclair (1971) asserted that sentence comprehension was also affected by the presence of certain types of verbs used in the sentence. Verbs which were complex were not as easily comprehended as were simpler verbs. For example, verbs such as "to break" ("Casser") were easily comprehended. Other verbs as "to follow" ("suivre") were more difficult. A verb as "to break" is non-reversible and has lasting effects upon the object. "To follow" implicates a spatial order wherein "the agent changes his place in constant relation to the patient, but it is the patient who

initiates the action" (Beilin, 1975). In addition, some verbs such as "to push" have a reversibility feature which increases comprehension difficulty.

Cromer (1970), using complex sentences such as "John is easy to see," found that correct interpretation of this structure was a late acquisition occurring after age six. The youngest subjects, with a mental age of 5.7 as measured by the Peabody Picture Vocabulary Test, tended to interpret the surface structure subject as being the actor of deep subject. However, after a mental age of 6.8, the deep structure was correctly recovered.

Three categories of children emerged from the data:

1. Primitive rule users - M.A. = 5.7 and below

   These subjects identified the surface subject as the actor of the deep subject. Therefore, sentences as "The wolf is happy to bite" were correctly interpreted. Sentences as "The wolf is easy to bite" were incorrectly interpreted.

2. Intermediates - M.A. = 5.9 - 6.8

   Children in this group gave mixed responses. Significantly more mistakes pertained to sentences wherein the adjective related to the object as in "The wolf is easy to bite" rather than to sentences

in which the adjective referred to the subject as in "The wolf is happy to bite."

3. Passers - M.A. = 6.8 - 10.8

This group identified as passers actually consisted of two types of subjects: the consistent passers, who more consistently identified the subject of the sentence correctly, and the inconsistent passers, who responded more like intermediates. The mental age of this latter group was lower than 6.8.

Recent research has focused on the acquisition of relative clause comprehension in children. Citing Hamburger and Crain (1982), the syntax of the relative clause is important in arguments for transformational grammar. It allows for recursion, novelty in language and self-embedding. Research has, therefore, sought to evaluate whether and how early child language is rule-governed.

Various terminology has been applied to relative clause constructions. Before proceding with the literature that concerns this construction type, the terminology applied to the restricted relative clauses, based on Sheldon (1974), will be provided. This terminology is based on identifying the position of the subject (S) or object (O) of the matrix verb or preposition that is relativized, and the position of the empty noun phrase inside the relative clause. In the following

classification, the subject or object of the verb that is relativized will be underlined (__), and △ indicates the empty noun phrase.

Classification of Sentences Containing Relative Clauses

1. Subject relative clause with subject focus (SS)

   (Also called subject relative center embedded)

   The dog that △ pushed the cat jumped over the fence.

2. Subject relative clause with object focus (SO)

   (Also called object relative center embedded)

   The dog that the cat pushed △ jumped over the fence.

3. Object relative clause with subject focus (OS)

   (Also called right branching)

   The dog pushed the cat that △ jumped over the fence.

4. Object relative clause with object focus (OO)

   (Also called right branching)

   The dog pushed the cat that the fence fell on △.

In a study comparing comprehension of "center-embedded" subject relative clause sentences (SS and SO) in children between the ages three to six, and aphasic adults, Caramazza and Zurif (1978) found that the three to four year olds relied "heavily" upon a semantic comprehension strategy. They, consequently, did not correctly interpret sentences which were syntactically constrained as in the case of

"object-relative" clause constructions as "The boy that the girl is chasing is tall." It was suggested that "little improvement" in the development of syntactic-like rule acquisition seemed to occur between the ages of four to five. Between the ages five and six, subjects seemed to reflect the use of syntactic cues to interpret sentences. However, this older group of subjects still appeared to use semantic and pragmatic interpretive strategies just as the youngest group demonstrated some use of syntactic regularities. At some point, it seems that the normally developing child appears to increasingly turn to grammatical regularities while comprehension strategy usage seems to diminish.

Goodluck and Tavakolian (1982) tested the comprehension of OS relatives in four and five year old children through the use of a toy manipulation paradigm. They hypothesized that by reducing the number of animate noun phrases from three to two, there would be a higher proportion of correct responses. For example, a sentence with three animate noun phrases as:

The dog kicks the horse that knocks over the sheep would increase the processing load for children. Therefore, an inanimate direct object in the relative clause was provided as in the following example:

The dog kicks the horse that knocks over the table. The prediction concerning animacy effects was supported, with no significant effects for age.

Hamburger and Crain (1980) also obtained high levels of correct responses to OS relatives in five year old children. They used a toy manipulation paradigm and controlled for animacy as in Goodluck and Tavakolian (1982), and additionally met the felicity conditions for the OS relative. Felicity conditions are contextual factors which, Hamburger and Crain argue, facilitate the comprehension of relative clause sentences. Thus, in a sentence comprehension task, methodology should meet the pragmatic constraints of the sentences. Meeting the felicity conditions for the OS relative requires the provision of enough animals consistent with the pre-suppositional demands of the restrictive relative clause. Therefore, in the sentence:

The duck stands on the horse that jumps over the pig

methodology must provide more than one toy horse, and only one duck and one pig to be consistent with the restriction which the relative clause imposes upon the object of the matrix, that is, that one horse out of two or more jumps over the pig.

Studies have been done concerning complement clause interpretation to further test for the presence of structural

analysis in young children. Research by Goodluck (1981) on children's progression in assigning control of the unfilled node of temporal complements according to the linguistic principle of C-Command was continued by Hsu (1981).

Using the toy manipulation paradigm, Hsu examined children's progression interpreting complement sentences containing missing subjects, such as:

1. The cow kissed the pig after jumping over the fence and

2. The lion jumped over the bear after climbing up the ladder.

The complement clause contains an "unspecified" noun phrase in the subject position. Adults interpret "the cow" and "the lion" in sentences 1 and 2 respectively as the missing subject of the complement clause, i.e. as controller of the missing noun phrase. The universal principle of C(Constituent)-Command requires "the cow" and "the lion" to be the only possible controllers of the missing subject in the complement clause. The principle of C-Command states that a lexical noun phrase may control the missing subject position only if it is immediately dominated by a branching node which also dominates the missing NP position. (See Phrase Marker 1, Appendix A for sentence (1)). In sentence (2), the subject noun phrase, the lion, is immediately dominated by a branching node, S,

which also dominates the missing NP (marked by the delta). Thus, "the lion" is the only possible controller. On the other hand, the prepositional NP, "the bear" is not immediately dominated by the branching node, and is, therefore, blocked from controlling the missing NP.

Based on a comprehension task requiring children to act out sentences spoken to them, the following developmental stages were identified:

Stage 1: Subject Oriented Grammars (Mean age = 3.6)[1]

This stage represented the initial stage in the development of children's analysis of multiple clause sentences. Two findings occurred at this stage:

a) Multiple clause sentences were analyzed as conjoined simplex sentences;

b) The first NP was co-referential with the missing complement or relative clause NP. Children appeared to interpret the first noun phrase as subject of all subsequent verbs. Therefore, "the

[1]The ages cited here for the various grammatical orientations are different from those originally quoted in Hsu, Cairns and Fiengo. This is due to the authors' having divided Stage 2, Object Oriented Grammars, into 2 substages and finding age differences. These ages can be found in Cairns, H. and Hsu, J., Language Acquisition in the Child from Three to Nine (Proposal for research).

lion" is interpreted as the subject of the complement and relative clause sentences which follow:

3. The lion pushed the bear after climbing up the ladder

4. The lion pushed the bear that climbed up the ladder.

(See Phrase Marker II, Appendix A).

This approach to multiple clause interpretation leads to a correct interpretation of (3) and an incorrect one for (4).

Stage 2: Substage 1: Object Oriented Grammars without evidence of C-Command (Mean age = 4.9)

In this stage children manifest consistent patterns of object control. This stage replaces Stage 1, thereby permitting the attachment of the complement to the Verb Phrase. The Minimal Distance Principle is operative. Therefore, the NP nearest to the complement is interpreted as "controlling" the missing subject NP. Consequently, sentences (2) and (3) will be incorrectly interpreted. Sentence (4) will be correctly interpreted because the relative clause will be embedded in the object.

Sub-stage 2: Object Oriented Grammars with evidence of C-Command (Mean age = 6.0)

In this sub-stage, children are still object oriented but C-Command is in evidence. Therefore, sentence (1) will be incorrectly interpreted because the object, "the pig" is selected as the subject of the missing complement NP. However, because C-Command is in evidence, "over the bear" as in sentence (2) is analyzed as a prepositional phrase, thereby blocking the object NP, the bear, as controller of the missing subject in the complement clause.

Stage 3: Mixed Subject-Object Grammar (Mean age: 5.7)

This stage is a transitional stage between object oriented grammar and adult grammar. Children are beginning to attach complements to the S. However, performance is variable so that attachment can be to the S or VP.

Stage 4: Adult Grammar (Mean age: 7.7)

Adult patterns of sentence analysis for all construction types were produced by children who achieved this stage.

These grammar types correlated with both age and DSS scores.

Operation of C-Command

Research on the presence of formal universals as the C-Command constraint on control relate to the theory of

universal grammar which claims that children enter the language acquisition process with a set of innately specified principles. These principles which restrict and constrain the grammar constitute the language acquisition device (LAD). Evidence of formal principles in child language provides a basis for describing the child's transition to adult competence.

Three issues are important regarding the operation of formal universals:

Immediate Operation Hypothesis

Delayed Operation Hypothesis

Assumption of Inviolability

According to Hsu, the immediate operation hypothesis suggests that universals which have been identified in adult grammar are fully specified and operational from the beginning states of language acquisition. However, Hsu states that there is no reason for anticipating immediate operationality of universals in the child's grammar. It is possible that universal principles are "maturationally conditioned" and appear later in development. Hsu (1981) and Roeper (1982) propose that parameters of a specified principle appear only after the child encounters positive evidence in the form of a particular structure. The values of these parameters are, therefore, triggered by evidence from the environment.

The delayed operation hypothesis can account for the observation that during the acquisition phase, children exhibit language comprehension behaviors which seem to violate universals. These violations may be due to the misanalysis of a particular structure. Hsu's results suggest that C-Command is not immediately operational with respect to complements preceded by a locative prepositional phrase. Instead, this universal begins to apply sometime during the period when children manifest object oriented grammars and the prepositional phrase is analyzed as such. The object of the prepositional phrase is then blocked from controlling the unspecified noun phrase in the complement.

Metalinguistics and Cognitive Development

Metalinguistic abilities in children have been studied to determine if they can make explicit their underlying linguistic knowledge. Whereas sentence comprehension tasks permit the study of more or less immediate sentence interpretation, metalinguistic analysis permits the subject to reflect upon linguistic structure while avoiding the real-time constraints of a sentence comprehension task.

Early studies of children's ability to make well-formedness judgments (Gleitman, Gleitman and Shipley, 1972) found that, with an increase in age, children showed an

increase in their ability to reflect on, judge and explain grammatically deviant sentences (word order violations). The five year olds gave explanations which were paraphrases and statements such as the sentence is "not right." The older children gave answers which referred to "linguistic categories."

De Villiers and de Villiers (1972) studied two and three year olds and found that the more linguistically advanced children could judge and correct anomolous sentences better than the less linguistically advanced. However, the less linguistically advanced could judge better than they could correct. Performance on the judgment task correlated with mean length of utterance. The de Villiers used hand puppets in their task and the terms "right" and "wrong" to characterize how the puppets would be "saying" their sentences. Gleitman et al (1972) used the terms "good" and "silly."

Recently, research of cognitive development using a Piagetian conceptual framework has proposed a relationship between general cognitive development and the development of metalinguistic abilities. Hakes (1980) suggests that a relationship may exist between the emergence of the period of concrete operational thought and the greatest development of linguistic and metalinguistic ability. It is during this period of development that children become "increasingly able to deal systematically with relationships, both between

different properties of a situation and between those of the immediate situations and other past and possible situations." Prior to this period, the preoperational child is a "captive" of the immediate situation and uses strategies which interpret these situations. Consequently, children who demonstrate concrete operational thinking can interpret grammatical structures such as reversible passives with more success and can reflect upon aspects of language more systematically than the preoperational child.

Early work attempted to determine if there was a relationship between cognitive development and the syntactic comprehension of the passive construction. Beilin (1975), for example, concluded from results of his experiments using reversible passive constructions that children who demonstrate fully correct passive constructions are those who demonstrate "high reversibility levels"; "primitive attempting responses are made by low reversibility level subjects." Beilin suggested that to some extent this is independent of age and more highly correlated with ability to perform concrete logical operations.

Genevan studies of the passive voice reported concurring results. Sinclair and Ferreiro (1970) and Sinclair, Sinclair and de Marcellus (1971) concluded that true comprehension of the passive construction as reflected by comprehension of

full reversible passives is based on the development of operative cognitive structures.

Beilin suggested that the ability to comprehend reversible passives and complex verbs is related to the mature emergence of the concrete operative period. Although sensorimotor intelligence (between one and a half to two years of age) permits a more elementary form of reversibility, a more advanced level is reached by age six or seven at which time children have the capacity to deal with tasks of conservation, seriation and classification.

More recently, metalinguistic abilities have been studied in children to characterize the change in linguistic awareness as age increases. The central aspect of concern in "linguistic awareness is an attention shift from content to form..." (Lundberg, 1978). Hakes (1980) claims that children manifest different types of metalinguistic abilities throughout their linguistic development. What characterizes mature metalinguistic development is a change in the "systematicity" and "variety" of their performance in middle childhood. However, the development of "alternative, concrete operational means for interpreting and responding to situations does not entail the abandonment of the earlier developed inferential strategies.

Hakes (1980) found a correlation between the three different metalinguistic tasks he gave (segmentation, well-formedness, and synonomy) and conservation in a population of children ranging in age from four to eight. A sequence in the pattern of judgments in the well-formedness task was identified. Initially, judgments were made on the basis of comprehensibility exclusively and then making judgments based on comprehensibility and content. Syntactic and semantic judgments were then added to the sequence. Hakes found seven to eight year olds most capable of systematically making syntactic well-formedness judgments.

On the synonomy task, the sequence identified changed from the use of no consistent judgment criterion, to using a "form" criterion and then combining both form and meaning.

Hakes used sentences in his synonomy task which his subjects understood on the basis of results of a picture selection task. The synonomy task appears to be a more difficult task than the well-formedness judgment task because "the judgment requires constructing, retaining, and comparing representations of the meaning of two sentences" (p. 69). In spite of the demands of this task, Hakes found an improvement in performance, with an increase in age, on the synonomous sentence pairs. He suggested that making a synonomy judgment

requires retaining (conserving) the first meaning and form, and comparing it with the second meaning and form.

Sentence Comprehension in Reading Disabled Children

Previous research has found that children with reading disabilities are deficient in their use and comprehension of syntax. For example, studies have presented evidence that poor readers do not use syntax to aid in decoding written material (Cromer and Wiener, 1966); they demonstrate syntactic deficits in written language (Anderson, 1982). Guthrie (1973) found that reading impaired children do not use syntax effectively in choosing between lexical alternatives in a Cloze testing procedure.

Vogel (1975) found that reading disabled subjects were deficient in areas measuring oral syntax and found a significant correlation between oral syntax scores and reading comprehension scores.

Badian (cited in Menyuk, 1981, p. 50) found that "middle-aged" children with severe reading difficulties exhibited difficulty in processing relativized sentences. Wallach (1977) also found that reading disabled children had deficits comprehending relativized sentences and used a number of different strategies to interpret sentences such as an order of mention strategy. Goldsmith (1980) tested

comprehension of relativized sentences in a population of reading impaired children. Subjects were found to rely heavily upon an order of mention strategy in addition to using less efficient strategies in both auditory and written modes of stimuli presentation. One such strategy, termed "mutual action," related to the use of the two matrix noun phrases in the relative clause. Byrne (1981) found that reading disabled children performed more poorly in comprehending sentences in which the surface subject was different from the underlying subject as in "John is easy to please."

Sentence Comprehension Deficits in Broca's Aphasics

Samuel Orton (as cited in Rapin, 1981) compared children with developmental disorders of language, reading and writing to adults with acquired aphasia, alexia and apraxia. Studies of syntactic comprehension in adults with Broca's type aphasia will be cited "assuming," as did Orton, that it "would shed light on the children's disorders" (Rapin, 1981).

The language production of the Broca's aphasic has been characterized as "agrammatic" in that there appears to be a reduction in the usage of the grammatical words of the language. Studies of sentence comprehension in these subjects, who previously were not considered to be deficient in language comprehension as has been the case with adults with Wernicke's

aphasia, find comprehension deficits. In a sentence comprehension task, Scholes (1978) compared normal seven and nine year olds with Broca's aphasics. On sentences containing indirect and direct objects following the verb as in "He should her the baby pictures," Scholes found that the seven and nine year olds made 74% and 86% correct responses as compared to 54% for the aphasics.

Studies have demonstrated that Broca's aphasics appear to rely on semantic cues to obtain meaning from syntactically constrained relative clause sentences such as in "The boy that the girl is chasing is tall" (Caramazza and Zurif, 1976; 1978), in contrast to normal six year olds who demonstrated above 95% accurate responses (Caramazza and Zurif, 1978).

Furthermore, Broca's aphasics do not appear as dependent on a word order strategy as do younger children (Caramazza and Zurif, 1978) and do not even reliably use an order strategy in interpreting sentences (Schwartz, et al, 1980).

Metalinguistics in Reading Disabled Children and Aphasics

Studies of the metalinguistic abilities of good and poor readers demonstrate that children with reading disability do not perform as well as their reading-age peers. Menyuk and Flood (1981) investigated metalinguistic ability in the form of grammaticality judgments and corrections of oral

and written sentences. In general, the youngest good readers (fourth graders) performed better than the poor readers at every grade level. There was no significant difference in performance with respect to modality of processing.

Salus (1982) assessed the syntactic and metalinguistic abilities of early readers, their non-reading peers, and reading peers who were older. She found that there was no significant difference in performance at judgment and repair between the early readers and the older reading peers.

Tests of grammaticality were given to reading impaired children between the ages 7.4 - 8.5 (Vogel, 1975). Subjects were asked to state whether sentences were grammatical. They were told to listen specifically to one target word before each sentence was read to them; the target word was either grammatical or deviant as then read in the sentence. Based on this methodology, no significant differences were found between the experimental and control subjects.

Regarding studies with Broca's aphasics, Zurif, Caramazza and Myerson (1972) found metalinguistic deficits in this population in a hierarchical clustering task. In another study, Gardner, Denes and Zurif (1975) administered a well-formedness task to aphasic adults with anterior and posterior lesions of the dominant hemisphere. The mode of presentation was both auditory and visual. In general,

sentences containing syntactically anomolous sentences posed more difficulty for subjects than semantically anomolous sentences. Sentences were administered in pairs. Results demonstrated that on the written form of the task, the patients with the more severe comprehension defects would match the two sentences of the pair and cross out the element not common to both.

In a judgment task of prepositions, Friederici (1982) found that although Broca's aphasics tended to omit or substitute prepositions in production, their acceptability judgments were better. As prepositions have a syntactic and semantic function, it was concluded that it is not necessary to compute its structural information to make an acceptability judgment.

Other studies have examined the Broca's aphasic's ability to make acceptability judgments of personal pronouns (Morton and Patterson, 1981) and reflexive pronouns, transitive and intransitive verbs (Linebarger, Schwartz and Saffrin, 1983). Whereas Morton and Patterson found their subject had difficulty making correct judgments of sentences containing altered personal pronouns, Linebarger's subjects were able to make correct judgments. Neither researcher, however, appears to have examined their stimulus items for syntactic or semantic functional differences as did Friederici. In

addition, the question is raised as to whether Linebarger et al's subjects were responding to the examiner's intonation of the presented stimulus material, or whether they were indeed relying upon syntactic knowledge.

Based on the theory that a language disorder underlies reading impairment, this study proposed to explore various syntactic aspects of language development in reading disabled children.

Motivated by previous research of the normal acquisition of complex sentences and the operation of the universal principle of control, a sentence comprehension task, presented both auditorily and visually, was designed to explore syntactic development and classify reading impaired and skilled readers according to grammatical orientation and evidence of the C-Command Constraint on control. Error patterns were identified.

This study also proposed to explore the ability of reading impaired subjects to make metalinguistic judgments. A synonomy task, presented auditorily and visually, containing the sentence types tested in the comprehension task was administered. A well-formedness judgment task of structures not examined in the comprehension task was presented to determine if reading impaired subjects would perform as well as the skilled readers. In addition, a determination was

made as to whether function and content word items manifested distinctive patterns of difficulty.

Finally, the ability to perform the concrete operations required in a conservation task was explored and a correlation between metalinguistic and cognitive development was made in response to suggestions that a relationship exists between metalinguistic and cognitive development.

Hypotheses

Hypothesis 1: Modality

Reading impaired subjects should evidence similar performance, regardless of mode of presentation, on the comprehension task because of an underlying linguistic impairment.

Hypothesis 2: Sentence Comprehension

Reading impaired subjects should demonstrate more difficulty than skilled readers comprehending complex sentences because a syntactic interpretation is required.

Main Effects

A) Constraint on Control

Based on performance of the two complement constructions and the OS relative clause sentences, and guidelines established by Hsu (See Appendix I;

p. 118), reading disabled subjects will demonstrate more immature levels of grammatical orientation and C-Command.

B) Word Order and Semantic Effects

Active and non-reversible passive sentences should be the easiest constructions for which to supply a correct answer. A NVN word order interpretive strategy or reliance upon semantic cues may be applied to active and non-reversible passive sentences respectively.

C) Reversibility Effect

1. Reversible passive sentences may be more frequently misinterpreted than non-reversible passives by reading impaired subjects because, in the absence of semantic cues, they may tend to apply a NVN word order strategy to interpret this construction.

C) Effect for Sentence Type: Error Patterns

1. SO relative clause sentences should be the sentence construction which will be the most difficult to interpret for all subjects. This sentence type requires that the relative clause be embedded in the subject, a syntactic form of interpretation. There is no comprehension strategy

which would give the same result. It is predicted that reading impaired subjects will exhibit more difficulty than control subjects. It is also predicted that a conjoined clause analysis[2] will be one of the means of interpreting the SO relative clause sentence.

2. The conjoined clause form of analysis will be used in interpreting OS relative clause sentences in the case of subject oriented children as well as an hypothesized attachment of the relative clause to the main S node in mixed subject-object children.
3. OO relative clause sentences will be difficult for reading impaired subjects to interpret. Utilization of the conjoined clause analysis will lead to an incorrect interpretation.

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[2]Tavakolian has hypothesized that children utilize a conjoined-clause analysis to interpret relative clause sentences and that this is an early form of structural analysis. She has acknowledged that it might be argued that children may be using a nonstructural strategy. She argues, however, that the conjoined clause analysis suggests "an order of development for recursive rules in the grammar" which initially takes the form of iteration rather than embedding, p. 185.

Hsu, Cairns and Fiengo (in preparation) suggest the "conjoined clause analysis" is a processing strategy and that there is no underlying motivation to characterize it as a structural form of analysis.

Hypothesis 3: Metalinguistics

Reading disabled subjects will perform more poorly on metalinguistic tasks than skilled readers.

Main Effects

1. Synonomy judgment scores for all subjects should be poorer than comprehension scores because of the nature of the task as previously mentioned. (See Chapter 1, p.21). Reading disabled subjects should perform more poorly than the control subjects indicating a deficit in structural knowledge.
2. Reading impaired subjects should exhibit poorer performance than skilled readers on a well-formedness judgment task. All subjects should perform better on this task than on the synonomy task. Observation for differences between open and closed class items will be made.

Hypothesis 4: Conservation

Reading impaired subjects will exhibit poorer performance on the Goldschmid-Bentler Test of Conservation than the control subjects.

Appropriate tests will be performed to determine if a relationship exists between metalinguistic and conservation scores.

CHAPTER II

METHODOLOGY

Four tasks were presented to all subjects over four one-half hour sessions. The tasks were arranged in three counterbalanced order groups, and each subject was placed in one of the groups. (See Appendix H, p. 117 for design).

Sentence Comprehension Task

Sentences containing the following constructions were presented to individual subjects in both the experimental and control groups:

1. Simple Active Declarative

   The little cat bites the tall boy on the hand.

2. Non-Reversible Passives

   The ball is hit over the fence by the boy.

3. Reversible Passives

   The cow is kicked in the leg by the horse.

4. Subject Relative Clause with Object Focus (SO)

   The monkey that the lion hugs rolls the ball.

5. Object Relative Clause with Subject Focus (OS)

   The cat taps the rabbit that kicks the pail.

6. Object Relative Clause with Subject Focus (OO)

   The dog kisses the cat that the bush scratches.

7. Direct Object + Adverbial Temporal Complement

   The cat feeds the dog after pushing the rock.

8. Locative Propositional Phrase + Adverbial Temporal Complement

   The bear stands near the tiger after sleeping on the ground.

SS relatives were omitted because they were considered too easy a construction to discriminate between groups.

All sentences contained two animate noun phrases and one inanimate noun phrase as in Goodluck and Tavakolian (1982); see p.10. All sentences were equated for length.

Half of the sentences were presented auditorily to subjects individually in one session. The other half was presented visually in another session. Each stimulus sentence in the written format was typed on a 4 x 6 index card. Sentences were presented in a planned, randomized order with eight sentences in six blocks. The same non-complex transitive verbs were used for each construction type. The verbs scratches and touches were used only in the oral presentations. (See Appendix B, p.100 for a list of the stimulus verbs).

Different sentences were created through variation of the noun phrases around the stimulus verbs. (See Appendix B, pp. 100-103 for all the stimulus sentences).

Subjects were required to act out the sentences they heard or read aloud by moving the toys which were arranged on the table at which they sat. Sentences were spoken as many times as was necessary for the subject to begin acting them out. Visually presented sentences were placed on the table in front of the subject. Each one was left in front of the subject throughout the enactment of that sentence. Subjects were aided with reading whenever they asked for help or read incorrectly.

One toy for each noun phrase was used in contrast to Hamburger and Crain (1980); see p. 11. It was thought that having too many toys from which to choose would create confusion for the reading impaired subjects, and possibly a biasing condition toward the head of the relative clause for the control subjects. The only noun phrases for which two toys were provided were those which were modified by an adjective such as "the little girl" or "the brown horse."

The experimenter recorded the subjects' observed toy moving behavior along three dimensions: the noun phrase chosen as sentence subject/actor; sentence object; and number of clauses acted.

Responses were scored for the correctness of subject and object choice, and enactment of the matrix and relative or complement clause; error responses were classified according to comprehension strategy or structural analysis identified by the pattern of enactment.

Metalinguistic Tasks

Well-Formedness Judgments and Explanations

Sentences were presented in spoken and printed form in separate testing sessions as in the comprehension task. Sentence pairs were presented as in Gardner, Denes and Zurif (1975) wherein one sentence of each pair was ungrammatical. Subjects were asked to identify the ungrammatical sentence of each pair.

In the auditory presentation, subjects were shown two puppets that would take turns "saying" sentences which were "wrong." The term "silly" was also used in the instructions. Subjects were asked to point to the puppet that said the sentence which was "wrong." After each judgment, subjects were asked "why" they thought a sentence was wrong.

The same puppet always began a sentence pair, but the deviant sentences were assigned to each puppet in a planned, randomized order. Sentences were repeated as many times as

was necessary for subjects to form a judgment. (See Appendix G, p.116 for sentence randomization).

In the reading segment of the task, subjects were given two cards; one contained the deviant sentence and the other the grammatical sentence. Subjects handed the examiner the deviant sentence. As in the auditory form of the task, explanations were elicited from subjects and recorded.

Sentences were scored for correctness of judgments. Explanations were classified according to the following criteria: statements reflecting what was termed non-reasoned, stereotypic expressions, plausibility and/or consequence statements, and linguistic explanations. (See Table 11, p. 67 for explanations of these categories).

The following are examples of well-formedness sentence pairs:

Transitive Verbs

*The children liked from their parents.

The children liked the presents from their parents.

Intransitive Verbs

*The passenger yelled the driver.

The passenger yelled to the driver.

Locative Prepositional Phrase

*The plane flew for the clouds.

The plane flew above the clouds.

Reflexive Pronouns

*The girl rode the bike by itself.

The girl rode the bike by herself.

Articles

*The girl lost all of baseball cards.

The girl lost all of the baseball cards.

(See Appendix B, pp.100-103 for all well-formedness sentence pairs).

Synonomy Task

The synonomy task required subjects to judge whether two sentences were paraphrases. This task was also presented auditorily and visually during two separate sessions. Subjects were requested to judge whether the sentence pairs meant the same thing. Trial sentences contained reversals of the noun phrases in simple active declarative sentences; this sentence type was used only as the paraphrase for the two passive constructions in the synonomy task itself. An example of a trial sentence pair was:

The girl washes the doll in the tub. (Target)

The doll washes the girl in the tub. (Non-synonomous)

Trial sentences contained a non-synonomous second sentence for the target sentence.

Except for active declarative sentences, the constructions used were the same as those used in the comprehension

task. The same verbs were used as well although different animal types were added to the list of noun phrases used. Six blocks of seven sentence pairs were presented. Each block of seven sentence pairs contained one sentence of each construction; sentences within each block were presented in a planned, randomized order. To aid motivation and attention, subjects received a small toy intended as reinforcement.

In the oral presentation, sentence pairs were read with intonation and repeated as many times as necessary for the subjects to make a judgment. The written form of the task contained printed sentence pairs shown through a viewing window. Sentence pairs remained in front of each subject until a judgment was made.

For each relative and complement clause sentence, two non-synonomous and one synonomous sentence was created for each target sentence. For example, for the <u>target</u> sentence THE LION CHASES THE TIGER THAT ROLLS THE BARREL, the following synonomous and two non-synonomous sentences were devised:

S= THE LION CHASES THE TIGER AND THE TIGER ROLLS THE BARREL

NS_1= THE LION CHASES THE TIGER AND THE LION ROLLS THE BARREL

NS_2= THE TIGER CHASES THE LION AND THE TIGER ROLLS THE BARREL.

In order to permit the two non-synonomous and one synonomous sentence to be compared against the target, all subjects were divided into three groups, thereby accounting for the three variations of the target. This design permitted Group 1, for example, to receive the synonomous sentence with the target, Group 2 to receive NS_1 with the target, and Group 3 to receive NS_2. (See Appendix B, p.100 for the counterbalancing design).

The synonomy task was scored for correctness of judgment.

(See Appendix E, pp.110-114 for all sentence pairs).

Conservation Task

The Goldschmid-Bentler Concept Assessment Kit-Conservation Form A (1968) was administered to each subject as in Hakes (1980). The test is scored for a behavior response, an explanation response, and a total combined score. Separate scores for behavior and explanations can be obtained. Conservation of the following dimensions were tested:

Two-dimensional Space

Number

Substance

Weight

Discontinuous Quantity

At the end of each testing session, each subject received a small toy for reinforcement.

Subjects

The experimental group was composed of reading impaired subjects. Reading impairment was operationally defined as at least two years below grade level on reading tests administered by each school's qualified learning disabilities specialists. The control group was composed of subjects classified by their schools as grade level readers. Children were not accepted who were above grade level and/or in special Gifted and Talented programs.

Each group contained twenty subjects; half in the second grade and half in the fourth. The mean age for each group is as follows:

Group 1 (Reading Disabled - Second Grade) = 7.5

Group 2 (Reading Disabled - Fourth Grade) = 9.3

Group 3 (Controls - Second Grade) = 7.2

Group 4 (Controls - Fourth Grade) = 9.4

Age seven was chosen as the youngest age level because, by this age, full comprehension of reversible passives in normally developing children has been acquired. In addition, as seen from the research cited in Chapter 1, the ages six to seven appear to represent the years when children become

systematically more proficient in comprehending multiple clause sentences. Finally, by age seven, subjects will have been observed and tested for one to two years by their schools for reading development.

Based on information from the subjects' school records, all subjects had attained at least an average score on tests of intellectual functioning, and/or a composite of achievement tests of verbal and non-verbal functioning.

Due to the fact that the reading disabled subjects were drawn from different schools using differing testing protocols, there is no uniform set of intelligence scores, achievement or reading test scores which can be reported. Appendix K lists these various scores for the reading impaired group.

There were no subjects in the reading impaired group who displayed disruptive behavior patterns, hyperactivity or known to have primary emotional or neurological deficits. The nature of the language tests required subjects to be able to read the stimulus items. Therefore, children who could not decode sufficiently to read the test sentences did not qualify as subjects. This was determined in initial interviews.

Subjects for the control groups were obtained from the White Plains Public School System with the approval of the Deputy Superintendent of the White Plains Schools. Reading

disabled subjects were obtained from the White Plains Schools and from the Windward School for Learning Disabled Children with the approval of the school's director. Parent and local school permission was obtained.

All data were collected from February - May, 1982.

CHAPTER III

RESULTS

Comprehension Task

Hypothesis 1 predicted that there would be no significant difference in scores on the comprehension task in terms of mode of presentation. The results are offered in Table 1. An ANOVA carried out to test differences between the auditory and written modes of presentation yielded no significant difference between the two modes, $F(1,36)=.536$; $p=.469$. In addition, there was no interaction between mode of presentation and diagnosis, $F(1,36)=2.145$; $p=.152$. Hypothesis 1 may, therefore, be supported. This result would lend support to a theory of reading disability as influenced by an underlying language deficit.

Table 1 presents mean scores by mode and the results of an analysis by mode and diagnostic group using the Wilcoxon Matched-Pairs Signed Ranks Test.

Hypothesis 2 predicted that reading disabled children would perform more poorly than skilled readers on the sentence

comprehension task. The results of an analysis of variance support this prediction, $F(3,36)=27.34$; $p<.001$. Scores from the auditory and written modes were collapsed based on the results of Hypothesis 1. (See Table 2 for Means and SD by group).

Analysis of variance also showed a significant effect for diagnostic group, $F(1,36)=75.46$; $p<.001$. There was no effect for age indicating that age was not a major influence on the comprehension scores.

TABLE 1

SENTENCE COMPREHENSION:

COMPARISON OF MODE BY MEAN SCORES AND z SCORES
FROM THE WILCOXON MATCHED-PAIRS SIGNED RANKS TEST

	Auditory	Visual	z
Reading Disabled	32.6	32.4	-.382 ns p=.702(2-Tailed)
Controls	43.1	42.2	-1.524 ns p=.127(2-Tailed)

TABLE 2

SENTENCE COMPREHENSION:

MEANS AND STANDARD DEVIATION BY GROUP
(Total possible score = 96)

	Mean	SD
Group 1 (RD 7 & 8)	62.9	7.534
Group 2 (RD 9 & 10)	67.2	10.097
Group 3 (C 7 & 8)	84.7	4.372
Group 4 (C 9 & 10)	85.9	1.642

Significance = $<.001$

Grammatical Orientation and Emergence of C-Command

Based on guidelines refined in consultation with Hsu and Cairns (personal communication), both the control and experimental groups were classified according to grammatical orientation and the emergence of C-Command. (See Appendix I, p. 118.

The OS relative clause sentences and the adverbial temporal complements were used to classify subjects. Classifying for grammatical orientation was performed by comparing each subject's response on the OS relatives with responses to the adverbial temporal complement following a direct object.

A subject oriented grammar would be characterized by multiple clause sentences parsed as two simplex sentences with the first NP as subject of all subsequent verbs. Object oriented grammars are characterized by attachment of the subordinate clause to the VP. In object oriented grammars with evidence of C-Command, the complement following a direct object and the OS relative are still attached to the VP. However, C-Command is in evidence because the complement following a locative prepositional phrase is analyzed as such thereby blocking the object of the prepositional phrase from controlling the missing subject position. In the mixed subject-object grammars, a transitional stage between object

oriented and adult grammars, variable attachment of the complement to the S or VP occurs. Evidence of C-Command may vary. The adult grammar is characterized by attachment of the complement to the main S node. C-Command is reliably established.

Table 3 represents the classification of subjects by grammatical orientation and by C-Command.

TABLE 3

*CLASSIFICATION BY GRAMMATICAL ORIENTATION AND EMERGENCE OF C-COMMAND

	Subject Oriented Grammar	Object Oriented Grammar	Object Oriented Grammar + C-Command	Mixed Subject-Object Grammar	Adult Grammar	Unclass.	Total Subjects
RD 7/8			2	4	1	3	10
Level of C-Command			1 Dev 1 Low	4 Dev	1 Rel	2 Dev 1 Low	10
RD 9/10	1	1		6	1	1	10
Level of C-Command				1 No 2 Dev 3 Rel	1 Rel	1 Dev	7
C 7/8			1	3	6		10
Level of C-Command			1 Dev	3 Rel	6 Rel		10
C 9/10				1	7	2	10
Level of Command				1 Rel	7 Rel	2 Rel	10

RD = Reading Disabled; C=Control

No = No C-Command
Low - Low C-Command
Dev = Developing C-Command
Rel = Reliably high C-Command

*Figures represent the number of subjects per grammar type and in each C-Command level.

As can be seen from Table 3, 34 out of the total 40 subjects were classifiable according to Hsu's guidelines. The results show that 60% and 70% of the younger and older control groups, respectively, were classified at an Adult level of grammatical orientation as well as at a high C-Command level. In comparison, 10% in each of the reading disabled groups were classified at the Adult level, as well as at a high C-Command level.

Inspection of Table 3 demonstrates that 60% and 80% of the two experimental groups, respectively, were classified below the Adult level; most of the subjects were classified within the Mixed and Unclassifiable categories in the younger reading disabled group. Sixty percent of the older reading disabled group was classified in the Mixed grammatical orientation category.

Thirty percent of the younger controls and 10% of the older controls fell into the Mixed category.

Table 4 represents the C-Command levels for all groups. It is clear that 90% and 100% of the younger and older control groups, respectively, achieved a high C-Command level. Ninety percent and 60% of the younger and older experimental groups, respectively, appear to fall primarily within the categories identified as No, Low and Developing C-Command.

TABLE 4

PERCENT OF C-COMMAND LEVEL BY GROUP

	*No	Low	Developing	Reliable
RD 7/8	0	20	70	10
RD 9/10	30	0	30	40
C 7/8	0	0	10	90
C 9/10	0	0	0	100

*No C-Command

RD 9/10 = 1 subject
1 object
1 mixed

Word Order and Semantic Effects

A main effect was predicted for active and non-reversible (semantically constrained) passives in that they would be easy constructions to interpret. Active sentences can be successfully interpreted using a word order strategy. Non-reversible passives can be interpreted using semantic cues. Inspection of the means demonstrates near perfect scores for these two constructions for the experimental groups lending support for the above prediction. (See Table 5).

Reversibility Effect

A main effect was predicted for reversibility. Reversible passive sentences would be more difficult to interpret than non-reversible passives because a syntactic interpretation is necessary for a correct response. Inspection of the means demonstrates near perfect scores for the experimental groups. (See Table 5). Hence, the prediction that reversible passives would be more difficult to interpret was not supported.

Sentence Type Effect

A main effect was predicted for sentence type. It was hypothesized that SO relative sentences would be the most difficult of the sentences to interpret. This sentence type requires that the relative clause be embedded in the subject,

a syntactic form of interpretation. There is no comprehension strategy which would give the same result. Inspection of the means in the experimental groups (see Table 5), shows that although the scores for the SO relative were below the chance level, the OO relatives were even poorer. Inspection of the means for the control groups, however, demonstrates the predicted pattern in the older group. Therefore, the prediction that SO relatives would be the most difficult of the constructions to interpret was only partly supported.

TABLE 5

SENTENCE COMPREHENSION:
MEANS, STANDARD DEVIATION AND VARIANCE
(Number Correct)
(Maximum Score: 12 per sentence type)

	Reading Disabled-7/8			Controls-7/8			
	Mean	SD	Variance	Mean	SD	Variance	t-test
A	11.5	.71	.50	12.0	0	0	
NRP	11.6	.52	.27	12.0	0	0	
RP	10.9	.88	.77	12.0	0	0	
SO	4.1	2.02	4.10	9.3	2.30	5.12	5.41***
OS	8.0	2.10	4.44	11.0	1.50	2.22	3.67***
OO	3.4	1.71	2.93	9.5	1.90	3.61	7.54***
DO-C	5.5	2.84	8.10	7.9	2.73	7.43	1.93*
LOC-C	7.9	1.80	3.21	11.0	1.50	2.22	4.21***

	Reading Disabled-9/10			Controls-9/10			
	Mean	SD	Variance	Mean	SD	Variance	t-test
A	11.7	.67	.46	12.0	0	0	
NRP	11.4	.70	.50	12.0	0	0	
RP	11.1	1.10	1.21	11.9	.32	.10	
SO	5.2	2.66	7.10	7.7	3.23	10.50	1.90
OS	8.6	3.30	10.71	10.2	2.62	6.84	1.21
OO	4.0	2.11	4.44	9.5	2.42	5.83	5.43***

TABLE 5 - Continued

	Reading Disabled-9/10			Controls-9/10			
	Mean	SD	Variance	Mean	SD	Variance	t-test
DO-C	6.7	2.80	7.80	10.9	1.52	2.32	4.20***
LOC-C	8.5	3.40	11.40	11.7	.50	.23	2.99***

T-Tests(1-Tailed): .05=*; .025=**; .005=***

DO-C = Adverbial temporal complement following a direct object

LOC-C = Adverbial temporal complement following a locative prepositional phrase

Error Patterns

Comprehension errors were identified by apparent comprehension strategy and/or errors of attachment. Table 6 lists the error patterns and their descriptions.

Table 7 represents the percent of error type use per sentence construction. For the OS relative sentences, the conjoined clause analysis, a means of sentence interpretation wherein the first noun phrase is identified as the subject of all subsequent verbs, appeared to be the most common error as predicted. (See Appendix A, p.98 for the phrase marker of the conjoined clause analysis for interpreting OS relative sentences.

For the two complement sentence types, embedding the subordinate clause in the VP appeared to be the most frequent error pattern.

The largest proportion of errors for the OO relatives appeared due to the lack of animacy of the subject of the relative clause causing these sentences to be interpreted as OS relatives. For the SO relatives, the largest proportion of errors was identified by a strategy in which the first noun phrase acted upon the first verb. The second pattern used most frequently, primarily in the reading disabled groups, was the conjoined clause analysis.

TABLE 6

ERROR PATTERNS

Code	
0	Sentence was not understood.
1	Word Order Error - for passives, any NVN sequence is interpreted as SVO. Attachment Error - for complements, the subordinate clause is attached to the VP. EG: The dog pushes the cat after climbing up the ladder = "The dog pushes the cat and the cat climbs up the ladder."
1A	OO Relatives - the second noun and second verb act on the inanimate third noun phrase. EG: The cow chases the horse that the blanket covers = "The cow chases the horse and the horse covers the blanket."
1B	SO Relatives - the first noun is the subject of the first verb; the second noun is the subject of the second verb. EG: The cow that the horse chases jumps over the fence = "The cow chases the horse and the horse jumps over the fence."
2	The first NP is interpreted as the subject of all subsequent verbs.
3	No differentiation of NPs in the complement clause, relative clause of the OS relative, or preceding matrix verb of the SO relative.
4	Nonsyntactic error - substitution of NPs.
5	Outside NP serves as subject or object.
6	Incomplete - 1 clause is omitted.
7	Second verb is omitted.
8	NP2 is the subject for all verbs.

TABLE 7

PERCENT OF ERROR PATTERNS PER SENTENCE TYPE

	0	1	2	3	4	5	6	7	8	Total Errors
OS										
RD 7			57.5	7.5	22.5	2.5	5		5	40
RD 9			82		5.8	2.9			5.8	34
C 7			100							10
C 9			94		5.5					18
DO										
RD 7		61.5		15.	12.	1.5	3		6	65
RD 9		73.5		13	7.5		1.8		3.7	53
C 7		78		17					4.8	41
C 9		81.8		18						11
LOC										
RD 7		56		17	12		2.6		12.1	41
RD 9		57		20	8.5				11.0	35
C 7		70		30						10
C 9		66.6		33						3
OO		(1A)								
RD 7		52.8	18.3	4.5	12.6	1.0	2.2	4.5	3	87
RD 9	2.5	63.7	27.5		2.5		3.7			80
C 7		92	8.0							25
C 9		80	16				4			25

TABLE 7 - Continued

	0	1	2	3	4	5	6	7	8	Total Errors
SO										
RD 7		46.8	20	6	5	5	7.5		13.9	79
RD 9		35	32				2.9		29	68
C 7		55.5	11						33	27
C 9		51	23						25.5	43

Metalinguistic Tasks

Hypothesis 3 predicted that reading disabled subjects would perform more poorly on metalinguistic tasks than would skilled readers.

Synonomy Task

Although an analysis of variance which was performed on all the sentence types in the synonomy task demonstrated a significant difference between the two diagnostic groups, $F(1,36)=13.88$; $p=.001$, as well as the lack of an age effect, this result will not be considered as evidence in support of a metalinguistic deficit in the experimental group. Only the sentence types which were clearly understood by the experimental groups in the comprehension task will be analyzed for correct synonomy judgments.

Consequently, the mean correct scores for the reversible and non-reversible passive sentences will be reported here as these constructions were correctly interpreted by the reading disabled groups. (Active declarative sentences were not used as targets for synonomy judgments).

Results of t-tests of the means comparing the two diagnostic groups by age show that the 7/8 year old control group performed significantly better than the 7/8 year old experimental group on both passive constructions except in

the case of the written reversible passives. The 9/10 year old control group only performed significantly better than the 9/10 year old experimental group in the case of the written non-reversible passives. (See Table 8).

In both reading disabled groups, there are higher mean correct scores for the written presentations except in the case of the non-reversible passives in the 9/10 year old reading disabled group. (See Table 8). Neither control group demonstrates this modality difference.

Hypothesis 3 may be supported only in the younger subject groups.

TABLE 8

SYNONOMY SCORES:
MEANS, STANDARD DEVIATION AND VARIANCE FOR
REVERSIBLE AND NON-REVERSIBLE PASSIVES

	Reversible Passives						
	Reading Disabled, 7			Controls, 7			
	Mean	SD	Variance	Mean	SD	Variance	t-Test
Oral	2.8	1.31	1.73	3.8	1.03	1.10	1.889*
Written	4.0	1.25	1.60	3.9	1.40	1.90	.170ns
	Non-Reversible Passives						
Oral	3.0	.82	.70	5.3	.82	.70	6.272***
Written	4.1	1.30	1.70	5.4	.70	.50	2.807**

	Reversible Passives						
	Reading Disabled, 9			Controls, 9			
	Mean	SD	Variance	Mean	SD	Variance	t-Test
Oral	3.2	.92	.84	4.2	1.90	3.51	1.515ns
Written	4.2	1.40	1.95	4.7	1.06	1.12	.901ns
	Non-Reversible Passives						
Oral	4.9	1.20	1.43	5.5	.53	.28	1.450ns
Written	3.9	2.10	1.45	5.6	.70	.50	3.341***

(Maximum Score per modality = 6)

t-Test = 1-Tailed: .05*; .01**; .005***; df = 18

Well-Formedness Judgments

Hypothesis 3 also predicted that the reading disabled groups would perform more poorly on a task of well-formedness judgments in comparison to the control groups. The Mann-Whitney U-Wilcoxon Rank Sum W procedure was performed on each of the five grammatical categories. (See Table 9).

An analysis of variance could not be performed on these data because both control groups exhibited near perfect scores and little variance. (See Table 10, p. 65).

It can be seen from Table 9 that the difference between the experimental and control groups is highly significant for all but one grammatical category. Except for the category of Transitive Verb in the older reading disabled group, the control groups made more correct well-formedness judgments than the experimental groups regardless of age. (See Table 10 for correct mean scores per category).

Inspection of the means in Table 10 shows that performance on the function word items appears to be even poorer in the reading disabled groups than the two verb categories. However, there appears to be an increase in correct judgments in the older reading disabled group.

TABLE 9

WELL-FORMEDNESS SCORES:
MANN-WHITNEY U-WILCOXON RANK SUM W

	z Score	2-Tailed p
Reading Disabled and Controls - Ages 7/8		
Transitive Verb	-3.733	.0002
Intransitive Verb	-2.404	.0162
Locative Preposition	-3.397	.0007
Reflexive Pronoun	-2.880	.004
Article	-2.655	.0079
Reading Disabled and Controls - Ages 9/10		
Transitive Verb	-1.824	.0682
Intransitive Verb	-2.166	.0303
Locative Preposition	-3.110	.0019
Reflexive Pronoun	-3.465	.0005
Article	-2.008	.0446

TABLE 10

WELL-FORMEDNESS SCORES:
MEANS, STANDARD DEVIATION AND VARIANCE FOR
CORRECT WELL-FORMEDNESS JUDGMENTS
(Maximum score per category = 12)

	Reading Disabled, 7/8			Controls, 7/8		
	Mean	SD	Variance	Mean	SD	Variance
Transitive Verb	9.7	1.77	3.12	12.0	0	0
Intransitive Verb	10.6	1.84	3.80	11.9	.32	.10
Locative Preposition	8.8	2.10	4.40	11.4	.97	.93
Reflexive Pronoun	8.6	2.72	7.40	11.6	.97	.93
Article	9.4	2.30	5.20	11.8	.42	.18
	Reading Disabled, 9/10			**Controls, 9/10**		
	Mean	SD	Variance	Mean	SD	Variance
Transitive Verb	11.1	.73	3.00	12.0	0	0
Intransitive Verb	10.8	2.04	4.20	12.0	0	0
Locative Preposition	9.6	2.50	6.30	12.0	0	0
Reflexive Pronoun	9.2	3.00	8.62	11.9	.32	.10
Article	9.7	4.00	5.34	11.9	.32	.10

Subjects were asked to explain the reasons for their judgments. All correct judgments were classified by type of explanation. Table 11 identifies the types of explanations which emerged from the data for all subjects. Table 12 represents the percentage of each explanation type found in each grammatical category per group.

It can be seen from Table 12 that for each grammatical category, control subjects made a larger proportion of linguistic explanations than did the experimental groups.

The younger and older control groups demonstrate a maximum of 56% and 78%, respectively, of linguistic type reasons. The younger and older experimental group demonstrate a maximum of 15% and 21% of linguistic type reasons.

Generally, the younger reading disabled group gave more stereotypic explanations which were classified as "No Reason." A large percentage of responses in all groups appeared to simply refer back to one of the target sentences through a restatement or re-reading of the correct or incorrect sentence. A small percentage of explanations based on plausibility was found for all groups. All groups show a decrease with age of stereotypic answers. The older reading disabled group demonstrated an increase in oral and/or read re-statements of the target sentences.

TABLE 11

CATEGORIES OF WELL-FORMEDNESS EXPLANATIONS

No Reason (1)

This category reflects explanations which did not provide a reason for the subject's grammatical judgment. They appear to be stereotypic expressions such as: "I don't know;" "It doesn't make sense;" "It doesn't sound right."

Repeating or Re-Reading (2)

Explanations in this category refer fack to one of the sentences of the stimulus pair. The subject repeats the correct or incorrect sentence as the reason. For example, a subject might point to the incorrect sentence of the pair and say, "This is wrong because you said, 'The farmer fed on the farm.'"

Plausibility and/or Consequences (3)

This category reflects explanations of plausibility and/or consequences. For example, the statements: "Planes can't talk" and "The plane could crash" are respectively plausibility and consequential responses to the target sentence "The plane flew for the clouds."

Correct Linguistic Statement (4)

The subject reflects awareness of a grammatical error as in "This sentence doesn't tell you what the farmer fed" for the target sentence "The farmer fed on the farm."

Incorrect Linguistic Statement (5)

The subject provides a statement reflecting grammatical awareness but it is incorrect or incorrectly applied. For example, a statement such as "You can't use est with warm - only after a verb" is an incorrect grammatical statement.

Unclear Linguistic Statement (6)

A statement as "It's not put right in the sentence" is an example of an unclear linguistic statement.

TABLE 12

PERCENT OF WELL-FORMEDNESS EXPLANATIONS

Categories	1	2	3	4	5	6	Total Number
Transitive Verb							
RD 7/8	45.4	24.2	13.1	14.1	3	0	99
RD 9/10	25.7	47.5	6.9	18.8	0	0.9	101
C 7/8	12.6	52.1	0	35.2	0	0	119
C 9/10	4.9	23.9	1	70.2	0	0	121
Intransitive Verb							
RD 7/8	51.9	23.0	10.5	11.5	2.8	0	104
RD 9/10	34.0	51.0	4.0	11.0	0	0	100
C 7/8	25.4	50.8	1.6	22.0	0	0	118
C 9/10	3.0	49.5	5.0	40.3	1.0	0.8	119
Locative Preposition							
RD 7/8	46.6	21.1	14.4	14.4	2.2	1.1	90
RD 9/10	39.5	31.8	7.6	20.8	0	0	91
C 7/8	25.6	21.2	10.6	41.5	0	0.8	113
C 9/10	5.8	14.1	24.1	54.1	1.6	0	120
Reflexive Pronoun							
RD 7/8	34.3	27.0	13.5	14.5	2.0	8.3	96
RD 9/10	32.1	40.4	1.1	21.4	3.5	1.1	84
C 7/8	10.3	31.0	0.8	56.0	0	1.7	116
C 9/10	8.5	9.4	4.3	77.7	0	0	117
Article							
RD 7/8	46.8	30.2	13.5	9.0	0	0	96
RD 9/10	25.2	68.9	3.4	1.1	0	1.1	87
C 7/8	23.7	63.5	1.6	10.2	0	1.8	118
C 9/10	8.5	66.9	1.6	22.8	0	0	118

Conservation

Hypothesis 4 predicted that reading disabled children would perform more poorly on a task of conservation in comparison to skilled readers.

The Goldschmid-Bentler Concept Assessment Kit-Conservation was administered to all groups. A maximum score of 12 can be achieved which is a composite of a total of 6 for the two response categories: behavior and explanation. Table 13 reports the means for each group in terms of behavior and explanation responses. Table 14 represents z scores from the Mann-Whitney U-Wilcoxon Rank Sum W procedure comparing Conservation behavior, explanation and total scores.

As in the well-formedness judgment task, an analysis of variance was not performed as both control groups demonstrated high mean scores and little variance.

Given the poorer language scores reported thus far from previous tasks for the experimental groups, it would seem reasonable to consider the explanation scores as a less reliable indicator of the concept of conservation in the reading disabled groups.

However, even considering only the behavior scores, it can be seen from Tables 13 and 14 that the younger reading impaired group demonstrates a poorer conservation

score than the skilled readers of the same age group. The older experimental and control groups do not appear to differ significantly. In addition, there does not seem to be a significant difference in the explanation scores between the two older groups.

Hypothesis 4 may, therefore, be supported only for the younger reading disabled group.

TABLE 13

CONSERVATION:
MEANS, STANDARD DEVIATION AND VARIANCE

	Reading Disabled - 7/8			Controls - 7/8		
	Mean	SD	Variance	Mean	SD	Variance
*B	4.0	1.83	3.33	5.9	.32	.10
*E	2.9	1.60	2.54	5.8	.63	.40
Total	6.9	3.25	10.54	11.7	1.00	.90
	Reading Disabled - 9/10			**Controls - 9/10**		
	Mean	SD	Variance	Mean	SD	Variance
*B	5.8	.42	.20	6.0	0	0
*E	5.1	1.00	1.00	5.6	.70	.48
Total	10.9	1.10	1.21	11.6	.70	.48

B = Behavior, E = Explanation
Maximum Scores: Behavior = 6; Explanation = 6; Total = 12

TABLE 14

CONSERVATION:
MANN-WHITNEY U-WILCOXON RANK SUM W

Reading Disabled and Controls - 7/8

	z Score	2-Tailed p
Behavior	-2.82	.0047
Explanation	-3.74	.0002
Total	-3.73	.0002

Reading Disabled and Controls - 9/10

	z Score	2-Tailed p
Behavior	-1.45	.1462
Explanation	-1.30	.1923
Total	-1.54	.1224

Table 15 represents the breakdown of subjects by group according to Hakes' classification. (See Appendix J, p. 119 for Hakes' classification guidelines).

It can be seen that there are no preconservers in any group and that there is an increase in the number of conservers in the older reading disabled group. Although there is no significant difference between the behavior and explanation means and z scores in the older groups, the slightly poorer explanation scores in the older reading impaired group appear to cause fewer experimental subjects to be classified as full conservers. Therefore, 90% of each of the control groups are classified as conservers as compared to 60% in the older experimental group, and 20% in the younger experimental group.

A linear correlation coefficient was obtained to determine if there was a relationship between metalinguistic and conservation scores. Only the well-formedness judgment scores were used because of the lack of clarity of the nature of the synonomy scores.

Results show that there may be a correlation in the older reading disabled group between conservation and well-formedness, $r=.539$, $p.01$, and the younger control group, $r=.421$, $p.05$. (Correlations of .038 and -.201 in the

TABLE 15

CONSERVATION CLASSIFICATION
(Hakes)

	RD 7/8	RD 9/10	C 7/8	C 9/10
Preconservers	0	0	0	0
Transitional	8	4	1	1
Conservers	2	6	9	9

younger reading disabled and in the older control groups respectively, were clearly non-significant). The restricted range of high scores in the older control group may have produced insufficient variability upon which to base a correlation. On the other hand, the younger reading disabled group showed varying patterns including an inverse correlation between scores: high well-formedness and low conservation scores, low well-formedness and high conservation scores. Other subjects demonstrated similarity of direction for both tasks.

Therefore, a claim that there may be a correlation between metalinguistics and conservation can by only partially supported.

CHAPTER IV

DISCUSSION

The major focus of this study was directed at the theory that underlying reading disability is a language deficit. That is, regardless of the modality through which information is presented, reading disabled children do not appear to interpret the information as well as skilled readers. The results of this study appear to support this claim.

Comprehension

The results of the comprehension task indicate that skilled readers, regardless of age, performed significantly better than the reading impaired subjects. This difference in performance was maintained in both the oral and the written presentations of the stimulus material.

Due to the fact that subjects were helped with reading when they encountered difficulty, it may not be claimed that the written portion of the comprehension task was a true reading measure. Therefore, the claim that the scores for both modalities support the hypothesis that performance

would be similar regardless of modality must be cautiously asserted.

Patterns Relating to Sentence Type

The prediction that reading impaired subjects would have difficulty comprehending reversible passive sentences was not supported. These subjects were able to correctly identify the sentence subject in both the syntactically and semantically constrained passive sentences.

Research previously cited by Beilin (1975) points to an upper age limit of 7 at which time the reversible passive is fully comprehended. The claim can be made, then, that reading impaired children demonstrate grammatical development at least to the level of attaining the passive construction. This would indicate the achievement of the ability to assign the correct sentence subject in sentences deviating from the standard SVO word order.

Inspection of scores in the reading disabled group for the active, and passive sentences, however, does demonstrate slightly lower means whereas the control groups have achieved perfect scores. Due to this restricted range in the control groups, a statistical comparison of the means between the two groups would not necessarily yield valid results. It is, nevertheless, worth asking whether these good but still

lower than control group scores in the active and passive sentences reflect insecurity in the syntactic achievements of the reading disabled groups.

The relative and complement clause sentences were not as well comprehended by the reading disabled groups as were the active and passive constructions. As previously mentioned, the SO relatives have generally been found to be the most difficult of the relative clause sentences to interpret. In this study, the OO relatives appeared to be the most difficult of the constructions to comprehend for the two experimental groups. The SO and OO relatives appeared to be of equal difficulty for the younger control group. Only the older control group followed the pattern found in other studies wherein the SO construction was the most difficult to interpret.

It is possible to explain this result in terms of the animacy of the subject in the relative clause itself. That is, it was thought that by using two animate noun phrases and a third inanimate noun phrase in all the sentence constructions, the burden upon memory would be reduced, making these sentences easier to interpret than those with three animate noun phrases. In the case of the OO relative, the third, inanimate noun phrase is the subject of the relative clause, and consequently, the actor, as for example in:

1 2 3
The horse kicks the cow that the blanket covers.

It may be the case that the reading disabled subjects had difficulty assigning the status of subject of the sentence to an inanimate noun. If so, this may be further support for the hypothesis that reading impaired children may, at times, depend upon non-syntactic cues at a certain point of complexity.

The largest proportion of the errors reflected in the two complement sentences was the result of embedding the complement clause in the VP. This was found in all groups. Therefore, in a sentence such as:

The cow pushes the horse after climbing up the ladder the horse climbs up the ladder, which is an incorrect interpretation. As will be demonstrated later, patterns of subordinate clause embedding appear to characterize children at different stages of linguistic growth.

The largest proportion of errors for the OS relative sentences, in all groups, reflected the use of the Conjoined Clause Analysis. (See Table 7, p. 58). This is an early form of sentence parsing wherein the first noun is the subject of all subsequent verbs. As in the case of the complement sentences, the pattern of relative clause embedding appears to characterize different stages of linguistic maturation.

For the SO relative sentences, the largest proportion of errors appeared to reflect a variation of a word order strategy. The first noun of the matrix clause is identified as the subject of the first verb; the second noun, located in the relative clause itself, is the subject of the second verb. This pattern appears to ignore clause boundaries as in the following example:

1 2 1 2
The cow that the horse kicks pushes the pail.

Using this form of sentence interpretation, the cow kicks the horse, and the horse pushes the pail. This unusual pattern perhaps reflects the lack of a comprehension strategy or early structural analytic form which will provide a correct interpretation.

Classification by Grammatical Orientation and Emergence of C-Command

By using the OS relative clause sentences and the adverbial temporal complements following a direct object, subjects were classified according to grammatical orientation. The classificatory categories developed by Hsu were: Subject Orientation; Object Orientation; Object Orientation with C-Command; Mixed Orientation and Adult. The adverbial temporal complement sentences following a locative prepositional phrase were used to classify subjects according to

the emergence of C-Command. (See Chapter I, p. 12) for an explanation of the classificatory categories and Appendix I, p.118 for classificatory guidelines).

Seventy percent and 90% of the subjects in the younger and older experimental groups could be classified according to Hsu's guidelines in that these subjects were identified as demonstrating characteristic patterns associated with one of the classificatory categories. One-hundred percent of the younger reading disabled subjects and 70% of the older reading disabled subjects were identified as having some level of C-Command emergence. It is suggested that the majority of the reading impaired subjects in this study could be characterized as having a structural form of sentence interpretation.

As can be seen from the guidelines in Appendix I, p. 118, classification by grammatical orientation is based on the child's rule of control of the unspecified noun phrase in the direct object complements and in the OS relatives. The guidelines are based on the theory that children will manifest stages in their analysis of multiple clause sentences containing an unspecified noun phrase.

An early stage is hypothesized whereby multiple clause sentences are interpreted as conjoined clauses. This stage is identified as <u>subject oriented</u>. Children classified in

this stage manifest an apparently correct complement interpretation and an incorrect OS relative interpretation. The sentence is parsed into two simplex sentences with the first noun phrase as subject of the matrix and complement clause verbs.

Object orientation indicates incorrect complement interpretation and correct OS relative interpretation because of VP attachment of the missing NP. Mixed subject-object orientation indicates variability of attachment to either the S or VP of the matrix for the two constructions. Adult orientation indicates an attachment of the empty noun phrase to the S for the complement and object for the OS relative.

C-Command is evident within the second substage of object orientation when the prepositional phrase is correctly analyzed and the object of the preposition is blocked from controlling the missing NP.

Forty percent to 60% of the reading impaired subjects were classified as having a mixed subject-object grammatical orientation, indicating variable attachment of the complement and relative clause to the subject and object of the matrix. According to Hsu's results, the mean age of subjects at this stage was 5.7 years. Consequently, this finding may indicate that although the reading impaired subjects demonstrated grammatical orientation, their levels of grammatical

orientation appeared to be those of younger children. Only two out of a total of twenty experimental subjects could be classified at an adult level as compared to 60-70% of the two control groups. According to Hsu, the mean age of her adult oriented subjects was 7.7.

Therefore, it appears that the control groups demonstrate a movement toward linguistic maturation, wherein even the younger control subjects performed at higher levels that did the older reading disabled group.

Analysis of the emergence of the C-Command Constraint indicates that 90% and 100% of the two control groups demonstrated reliably high C-Command levels as compared to 10% and 40% in the experimental groups. As Table 3 shows, within the mixed category, there is variation regarding C-Command level in the experimental and control groups. All mixed control subjects show a reliably high C-Command level. However, the mixed reading disabled subjects demonstrate "no," "developing" and "reliable" C-Command levels.

Forty percent of the total reading disabled population was unclassifiable as compared to 20% of the older controls. The reading impaired subjects who were unclassifiable appeared to be in transition between subject and object orientation. The two controls who were unclassifiable also appeared to be in transition between subject and object orientation

although they tended to give more correct responses for the complement sentences than the reading disabled subjects.

On the SO and OO relative constructions, one of the controls demonstrated a pattern of selecting the matrix subject as coreferential with the missing relative clause NP. The other control subject exhibited mixed coreferential patterns. Their performance on the well-formedness and conservation tasks was as high as the other control subjects, but their synonomy scores appeared lower. It may be the case that the so-called "average" or "grade-level" readers do not form a homogenous group. Rather, there may be average readers who show immature aspects in their development as do these two subjects.

The picture that emerges from these data suggests that reading disabled children can be characterized as having a linguistic system which is, in part, in delay and, in part, different from non-disabled readers. That is, the interpretive patterns exhibited in the reading impaired subjects in this study can be described in terms of early forms of structural analysis as well as strategies. Most of these subjects appeared to be in a stage of attaining the linguistic universal examined in this study, i.e. C-Command, whereas 90% of all the control subjects demonstrated realiably established C-Command. This contrasts

with the data for the experimental group which shows 25% of the total 20 subjects as having reliable C-Command scores.

However, the difference between the experimental and control groups can be seen in the movement toward adult patterns of sentence analysis in the control groups and the lack of this movement in the reading disabled groups. In fact, the major movement within the 9/10 year old reading disabled group was toward an increase in the number of mixed subjects. In addition, the control group subjects who were classified as mixed all demonstrated reliably high C-Command levels in contrast to the reading disabled subjects who demonstrated varying C-Command levels.

Other evidence of a difference in the reading impaired group can be seen in their responses to the OO relative clause sentences. The mean scores for the OO relatives were poorer than for the SO relatives. This was not the case for the controls. The younger controls demonstrated mean correct scores which were approximately the same for the SO and OO sentences, and the older controls demonstrated a higher mean correct score for the OO relatives. It appears that the experimental group's interpretation of the OO relatives may have been influenced by the inanimacy of the subject noun phrase in the relative clause itself and,

consequently, had difficulty assigning the status of subject to an inanimate noun.

It may be the case that the language comprehension system of the reading disabled children studied here reflects the inhibition of grammatical maturation due to continued reliance upon early structural forms of analysis and comprehension strategies. It is also possible that their language comprehension system reflects a deficit in grammatical maturation which forces the reliance upon early forms of sentence interpretation.

Metalinguistics

The purpose of giving the metalinguistic tasks was to determine whether reading disabled children demonstrate the same development in linguistic awareness as do skilled readers.

Two types of metalinguistic tasks were used: a well-formedness judgment task of various structural violations and a synonomy judgment task of the same sentence types as used in the comprehension task.

Well-Formedness Judgments and Explanations

As the results demonstrate, there were significant differences in all structural variable scores between the

younger control and experimental groups, and in four out of five of the variables between the older control and experimental groups. (See Table 9, p. 64). Violation of the Transitive Verb structure, i.e. the omission of the direct object, did not result in a significant difference in scores between the two older groups. Higher judgment scores were found for the two verb structures tested than for the three function word items. (See Table 10, p. 65).

The difference in judgment scores for the Transitive Verb sentences was significant for the younger control and experimental groups. The reading disabled group appeared to accept sentences with objectless transitive verbs. A semantic cue interpretation is suggested to account for this error. The anomolous sentence of a pair such as:

The farmer fed the goats on the farm

*The farmer fed on the farm

could have been incorrectly judged as right if the verb "fed" was interpreted reflexively, that is, if subjects interpreted the incorrect sentence as meaning "The farmer fed <u>himself</u> on the farm."

Explanations for correct judgments were predominantly Type 1 (no reason) and Type 2 (repetition or re-reading). Neither explanation helps understand their judgment. Linguistic type explanations when provided by either the

control or experimental subjects demonstrated awareness that the verb needs an object as in: "The farmer has to feed something."

Although a statistical difference was found between the older groups for the Intransitive Verb category, the reading disabled groups still showed a high mean correct score for the two verb categories. It is suggested that the verbs contain more concrete, salient and imageable meanings for the reading disabled groups than do the function word items. Therefore, the omission of the preposition after an intransitive verb as in:

*The boy danced the girl.

is not reliably identified as anomolous by the reading impaired group.

The poorer scores exhibited by the reading disabled groups for the function word items (reflexive pronouns, locative prepositions, and articles) suggest that, in the case of omitted function words, structural importance was not recognized. For substituted function words (locative prepositions and reflexive pronouns), the difference in meaning was less clear for the reading impaired subjects.

Function words have a double status in that they impart meaning as well as cues to syntactic structure within the sentence. Both the structural and semantic aspects of the

function words tested appeared disrupted in this reading impaired sample. The difference found in scores between the content word and function word items may add further support to the claim of a syntactic deficit in the reading impaired group. This would not be an unexpected finding in light of the immature grammatical orientations and lower C-Command levels manifested by the reading disabled group in the comprehension task, and may be further evidence of a difference in the reading impaired group.

In general, the experimental and control groups appeared to differ in the proportion of linguistic type explanations. In addition, the reading disabled groups gave more "no reason," stereotypic explanations. This may, in part, be accounted for by a deficit in structural knowledge and, in part, by expressive language difficulties. Menyuk (1981) has discussed the occurrence of word-retrieval deficits, and other oral language skills which seem to be deficient in the reading disabled population.

It is interesting to note that with increasing age there was a general decrease in the percentage of Type 1 (stereotypic) explanations for all groups. There was also an increase with age in the experimental groups in the use of Type 2 explanations (repeating and re-reading). This

could be explained by a possible age-related increase in their ability to retain information and improvement in reading skills.

Synonomy

As previously stated, only those constructions which were reliably comprehended in the comprehension task were evaluated for synonomy judgments. Therefore, only the two passive constructions were compared for group differences.

The prediction that the reading disabled groups would perform more poorly than controls on a synonomy task was confirmed only in the younger experimental group in both oral and written presentations. No significant difference occurred between the older groups except in the case of the written non-reversible passive.

Hakes suggests that a synonomy task is generally a difficult one because of the need to retain two sentences in memory while processing them for meaning. Therefore, this type of metalinguistic task may underestimate ability to make language judgments because of the demands upon memory. This may suggest a reason for the lower non-reversible passive scores in the reading impaired groups.

Conservation

The hypothesis predicting that reading disabled children would perform poorer on a task measuring Conservation was

supported only in the younger reading disabled group. (See Tables 13 and 14, pp. 71 - 72).

As previously suggested, it is reasonable to consider the Conservation behavior means separately from the explanation means because of evidence of an expressive language deficit in the reading disabled population (Menyuk, 1981). In addition, the high proportion of stereotypic responses in this study's well-formedness explanations also suggests that expressive language would not be a reliable indicator of conservation understanding.

The poorer Conservation behavior score for the younger reading disabled group may indicate that concrete operational thought is not reliably established in this group. Therefore, even without the explanation means, the younger reading impaired group still appeared to be poorer conservers. Using Hakes' classification, which utilizes the total conservation score (see Table 15, p. 74), it is evident that 80% of the 7/8 year old reading impaired subjects were classified as Transitional Conservers as compared to 90% classified as Conservers in the 7/8 year old control group.

Although the difference between behavior, explanation and total scores was not statistically significant for the older experimental and control groups, (see Table 14), Hakes' classification shows 60% of the reading impaired subjects

conserving as compared to 90% for the older control subjects. The slightly lower explanation scores may account for this finding.

Conservation may be reliably established in the older reading impaired group. However, a ceiling effect may also account for the higher scores in the older groups. With older subjects, a conservation task alone may not be the best indicator of concrete operationality. Tests of classification and seriation can contribute additional information.

Conservation and Metalinguistics

Results for the 7/8 year old reading disabled group show no correlation between the well-formedness and conservation scores. Inspection of the well-formedness and conservation scores by subject showed variability regarding the direction of scores for both measures in addition to poorer scores for both tasks as compared with the 7/8 control group. In fact, instances of a low conservation score were seen with a high metalinguistic score, as well as the reverse pattern. Other scores reflected similar directionality.

There was a significant positive correlation between well-formedness and conservation in the 7/8 year old control group, but not in the older controls. This may have been due to the restricted high range of scores for both measures,

combined with a few cases of slightly lower scores in one of the variables.

The 9/10 year old reading disabled group demonstrated improved but still deficient metalinguistic scores, conservation scores which were not significantly different from the same age controls, and a positive correlation between well-formedness and conservation. Hakes described this pattern of an increase in systematicity as a common factor in metalinguistic judgments and cognitive operations with an increase in age.

Although the transition from a prelogical to a logical mode of thought signals this cognitive change, according to Piaget's theory (Goldschmid-Bentler, 1968), the ability measured by a task of conservation may be important, but not sufficient in tasks requiring grammatical judgments, particularly when the ability to make subtle syntactic and semantic distinctions is deficient. Furthermore, validity studies reported by Goldschmid and Bentler (1968) demonstrated that conservation, as measured by the scales in their test, had the highest positive correlation with achievement in arithmetic in a sample of seven year olds, (.52, $p=.001$).

The finding, then, in the tasks measuring metalinguistic ability and conservation is variability and no correlation between the two tasks for the 7/8 year old reading impaired

group. However, there may still be a metalinguistic deficit in the face of apparent cognitive growth. The control groups show strength in both areas measured but with the 7/8 year old group demonstrating a correlation.

It may be reasoned that concrete operationality is a necessary but not sufficient ability for metalinguistic growth to occur.

Conclusion

This study indicates that even with an increase in age the reading disabled groups did not demonstrate consistent linguistic maturation as did the skilled readers. They appeared to maintain the use of early linguistic rules and comprehension strategies which may interfere with, or may be the result of a delay in, the emergence of mature linguistic form. The reading disabled subjects evinced difficulty with the recursive aspect of embedded clause sentences. Metalinguistic limitations were evident, particularly in the case of function words, which further supports the claim of a syntactic deficit in this population.

There appeared to be a high proportion of reading disabled subjects classified in a transitional stage in tasks of comprehension and conservation. Mixed and unclassifiable subjects appear to be in transition between grammatical

orientations. For the conservation task, transition marks a stage in between prelogical and logical thought. There were few subjects classified at levels less mature than mixed grammatically oriented and no preconservers.

This pattern of transition could suggest gradual movement toward a more mature linguistic and cognitive level, and hence a delay in development. However, in the case of language development, it could also suggest a fixed stage of perpetual variability sustained by comprehension strategies and early structural analytic forms, permitting only minimal language advancement.

Implications for Treatment and Future Research

The evidence pointing to a continued delay in the grammatical development of reading disabled children suggests a need for direct language remediation in addition to the reading remediation these children receive. Precise sentence comprehension requires the interpretation of the syntax of the sentence as comprehension based on semantic cues and context alone is an approximation. Consequently, reading remediation, beyond the decoding stage, may only be as successful as the ability to make precise syntactic interpretations of oral sentences as a base for further semantic and pragmatic elaborations.

Furthermore, teaching reading disabled children to think about their language, its rules and patterns, may be a way of developing analytic abilities which might carry over into other areas.

Not all reading disabled children will be seen for language therapy due to costs and factors such as availability of treatment. Whether a child receives the services of a language pathologist, the classroom teacher will be a most important source of language remediation. Training teachers who work with this population in areas of language development and disorders should be part of their standard educational background. In addition, the patterns of instructional language significantly affect the way the reading impaired child will attend to and comprehend the teacher's instructions and questions.

Future research in the form of longitudinal studies of Grammatical Orientation and the emergence of C-Command as is being undertaken by Cairns and Hsu, as well as other aspects of grammatical development, is necessary to provide information regarding individual subject maturation. Similarily, studies of grammatical development, treatment and reading improvement would provide further verification of the relationship between language and reading. Comparisons with other language disordered populations regarding

Grammatical Orientation and C-Command could provide useful differential diagnostic information.

Further investigation of relative and complement clause development in oral production would add to the data regarding language development in the reading disabled population. A production metalinguistic task such as the anagram paradigm when combined with creating sentences to match observation or a picture representation of an action could provide information of the production of complex constructions as multiple clause sentences.

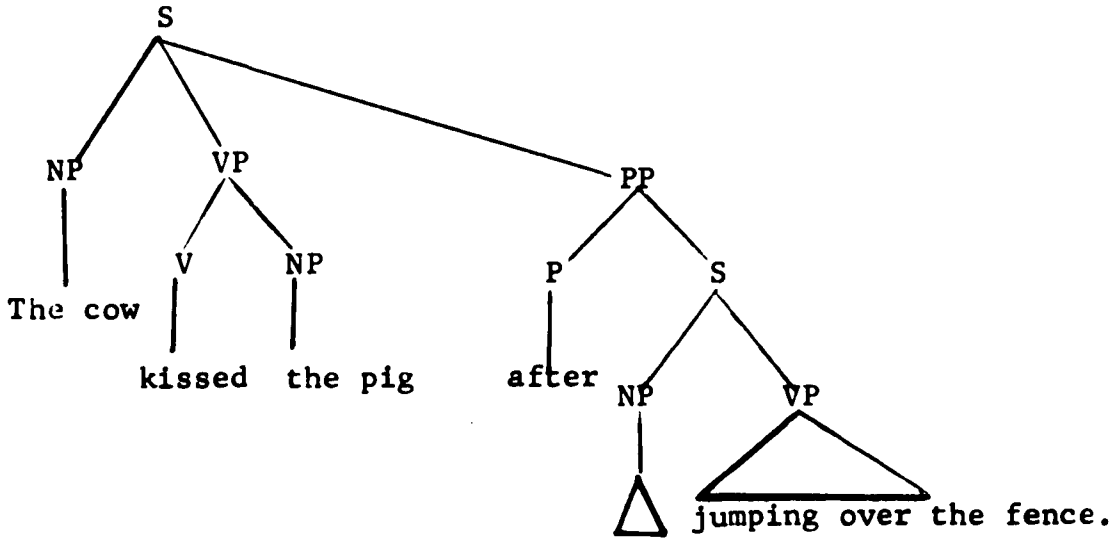
The issue of cognitive development and its relationship to metalinguistic ability is still open to much research. A more complete range of tests of concrete operations to more fully explore conservation in the reading impaired might include tests of classification and seriation in a longitudinal format.

An important issue to be studied through longitudinal language and cognitive experiments is the rate of linguistic growth in treated and untreated populations of reading disabled children to provide support for early language intervention in children identified as "at risk."

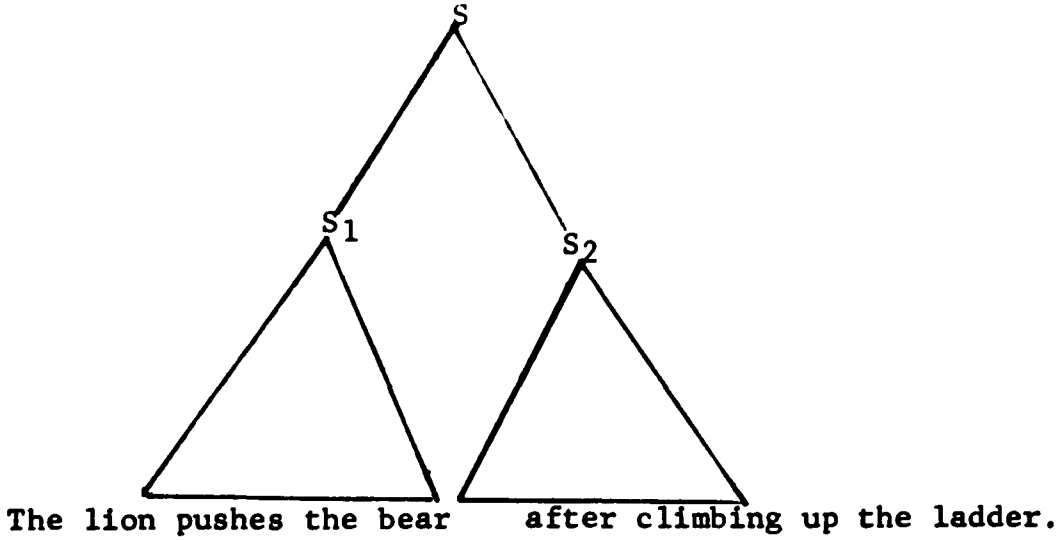
APPENDIX A

PHRASE MARKERS

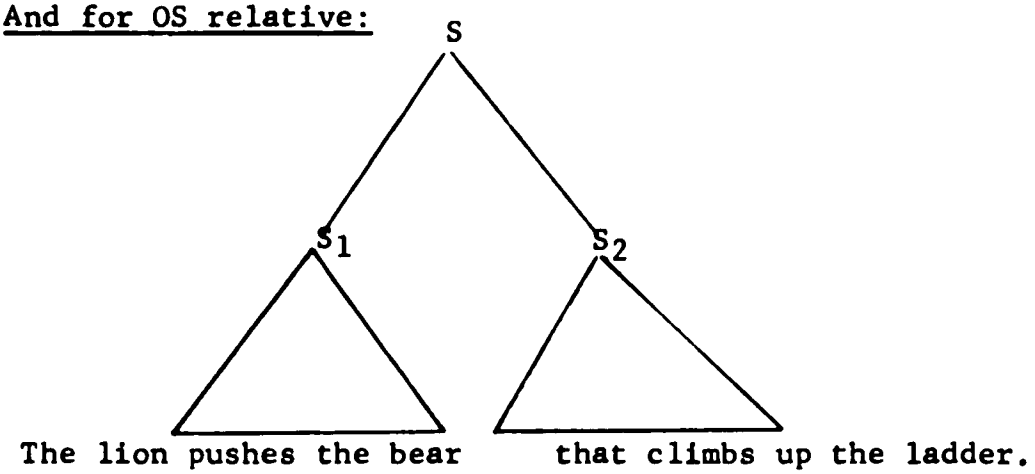
Phrase Marker #1: Structural analysis of adverbial temporal complement in adult grammar:



Phrase Marker #2: Subject oriented grammar for adverbial temporal complement:

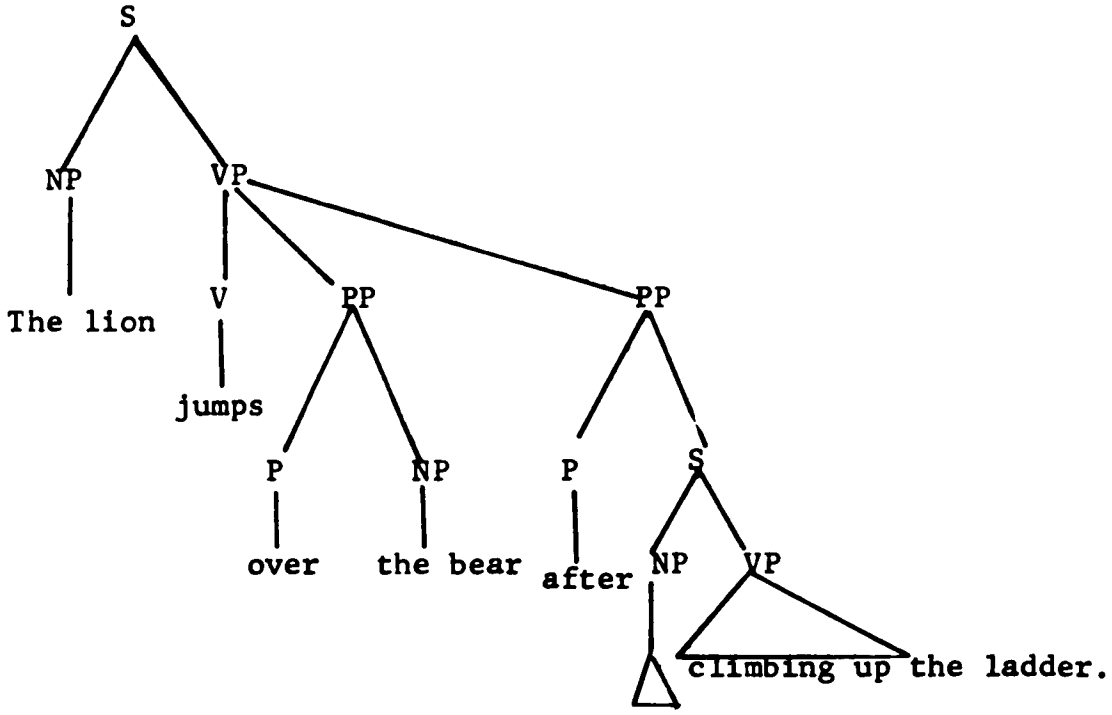


And for OS relative:



Phrase Marker 3: Object Oriented Grammar (Substage 2)

In the locative prepositional phrase, "over the bear" is analyzed as a branching prepositional phrase, blocking "the bear" as a possible controller of the empty NP.



APPENDIX B

COMPREHENSION TASK SENTENCES

Active

Oral

1. The big horse pulls the brown bear to the barn.
2. The big dog chases the tall boy around the barn.
3. The cat quickly scratches the little girl on the hand.
4. The little monkey gently touches the cat on the back.
5. The little boy pushes the tall girl off the chair.
6. The big tiger slowly washes the lion with a cloth.

Written

1. The little cat bites the tall boy on the hand.
2. The little girl hits the tall boy with her hand.
3. The big cow kicks the brown horse behind the barn.
4. The tall girl gently hugs the mother at the barn.
5. The brown dog softly taps the cat on the back.
6. The brown bear quickly kisses the lion by the fence.

Non-Reversible Passives

Oral

1. The ball is chased around the barn by the dog.
2. The chair is scratched on the back by the cat.
3. The doll is touched on the head by the girl.
4. The wagon is pulled down the road by the horse.
5. The doll is washed on the face by the boy.
6. The car is pushed down the road by the horse.

Written

1. The ball is hit over the fence by the boy.
2. The pail is kicked down the road by the horse.
3. The doll is hugged near the wagon by the boy.
4. The doll is tapped on the head by the girl.
5. The doll is kissed on the face by the girl.
6. The candy is bitten near the fence by the boy.

Reversible Passives

Oral

1. The girl is scratched on the arm by the boy.
2. The bear is touched on the head by the lion.
3. The cat is pushed off the chair by the dog.
4. The lion is washed with a cloth by the bear.
5. The lion is chased around the barn by the bear.
6. The dog is pulled behind the barn by the cat.

Written

1. The cow is kicked in the leg by the horse.
2. The bear is hugged near the barn by the lion.
3. The boy is tapped on the back by the girl.
4. The lion is kissed on the hand by the bear.
5. The dog is bitten on the tail by the cat.
6. The lion is hit on the head by the bear.

(SO) Subject Relative Clause with Object Focus

Oral

1. The dog that the cat touches pushes the wagon.
2. The tiger that the lion pushes runs around the barn.
3. The lion that the bear washes pushes the ball.
4. The bear that the lion scratches climbs up the ladder.
5. The rabbit that the cat pulls rolls the ball.
6. The horse that the cow chases picks up the pail.

Written

1. The monkey that the lion hugs rolls the ball.
2. The rabbit that the monkey taps kicks the pail.
3. The cat that the rabbit kisses sits on the rock.
4. The dog that the cat bites picks up the rock.
5. The bear that the lion hits runs to the ladder.
6. The cow that the horse kicks pushes the chair.

(OS) Object Relative Clause with Subject Focus

Oral

1. The tiger pushes the bear that climbs up the ladder.
2. The rabbit washes the cat that picks up the pail.
3. The dog pulls the cat that rolls the ball.
4. The horse chases the lion that pushes the pail.
5. The bear scratches the tiger that pushes the wagon.
6. The lion touches the tiger that runs around the barn.

Written

1. The cat taps the rabbit that kicks the pail.
2. The bear kisses the lion that pushes the chair.
3. The dog bites the cat that runs to the ladder.
4. The monkey hits the lion that picks up the rock.
5. The cow kicks the horse that sits on the rock.
6. The lion hugs the bear that rolls the ball.

(OO) Object Relative Clause with Object Focus

Oral

1. The tiger washes the lion that the ladder touches.
2. The cat pulls the rabbit that the basket covers.
3. The bear chases the lion that the car bumps.
4. The cat pushes the dog that the soap cleans.
5. The cow touches the horse that the pail hits.
6. The lion scratches the bear that the needle pokes.

Written

1. The dog kisses the cat that the bush scratches.
2. The bear bites the lion that the ball hits.
3. The rabbit hits the cat that the coat covers.
4. The horse kicks the cow that the wagon bumps.
5. The tiger hugs the lion that the string touches.
6. The lion taps the bear that the wagon pushes.

Adverbial Temporal Complement following a Direct Object

Oral

1. The lion carries the tiger after rolling the ball.
2. The bear taps the horse after climbing up the ladder.
3. The dog cleans the rabbit after kicking the pail.
4. The cat catches the dog after running around the barn.
5. The lion wakes the bear after sleeping on the ground.
6. The tiger dries the lion after pushing the wagon.

Written

1. The cat feeds the dog after pushing the rock.
2. The tiger pats the lion after rolling the pail.
3. The bear tugs the lion after climbing up the roof.
4. The cow pokes the horse after throwing the ball.
5. The dog shakes the cat after sitting on the floor.
6. The lion turns the tiger after running around the wagon.

Adverbial Complement following a Locative Prepositional Phrase

Oral

1. The cat sleeps near the dog after climbing up the ladder.
2. The lion hops behind the tiger after rolling the ball.
3. The rabbit sits behind the dog after carrying the pail.
4. The bear stands near the tiger after sleeping on the ground.
5. The dog crawls to the cat after running around the barn.
6. The cow walks behind the horse after pushing the wagon.

Written

1. The cow runs from the horse after throwing the ball.
2. The horse walks near the bear after climbing on the roof.
3. The cat looks behind the dog after sitting on the floor.
4. The tiger falls behind the lion after running to the wagon.
5. The bear sits behind the lion after pushing the rock.
6. The lion stands behind the cow after rolling the pail.

APPENDIX C

COMPREHENSION TASK

List of Verbs

Bites	Washes
Chases	Carries
Hits	Cleans
Hugs	Wakes
Kicks	Dries
Kisses	Feeds
Pulls	Pats
Pushes	Pokes
Scratches	Shakes
Taps	Tugs
Touches	

Verbs for Adverbial Temporal Complements following a Locative Prepositional Phrase

Stands behind	Looks behind
Stands near	Falls behind
Sleeps near	Hops behind
Crawls to	Runs from
Walks near	Crawls to
Sits behind	

APPENDIX D

WELL-FORMEDNESS TASK SENTENCES

Transitive Verbs

Oral

1. The farmer fed the goats on the farm.
   *The farmer fed on the farm.

2. Mary greeted Bill at the door.
   *Mary greeted at the door.

3. The children liked the presents from the teachers.
   *The children liked from their parents.

4. The girl answered a question from the teachers.
   *The girl answered from the teacher.

5. Luke defended his friends from the man.
   *Luke defended from the man.

6. The boy opened the book to read.
   *The boy opened to read.

Written

1. The sick boy took medicine to get better.
   *The sick boy took to get better.

2. The judge threw a book across the room.
   *The judge threw across the room.

3. The boy scared the birds nesting in the tree.
   *The boy scared nesting in the trees.

4. The boy has not touched his food yet.
   *The boy has not touched yet.

5. The girl brushes her teeth clean everyday.
   *The girl brushes clean everyday.

6. Jim closed the door to the space ship.
   *Jim closed to the space ship.

Intransitive Verbs

Oral

1. The boy wondered about the story.
   *The boy wondered the story.

2. The girl laughed at the joke.
   *The girl laughed the joke.

3. The passenger yelled to the driver.
   *The passenger yelled the driver.

4. The child cried about the toy.
   *The child cried the toy.

5. The girl coughed from a cold.
   *The girl coughed a cold.

6. The boy sits on a chair.
   *The boy sits a chair.

Written

1. The family went for a ride in the car.
   *The family went a ride in the car.

2. Fred danced with the girl every time.
   *Fred danced the girl every time.

3. The boy is thinking about his bike.
   *The boy is thinking his bike.

4. The boy joked about his singing.
   *The boy joked his singing.

5. The girl can hop on one foot.
   *The girl can hop one foot.

6. The tall man looked like a king.
   *The tall man looked a king.

Locative Preposition

Oral

1. Put down your books when you come home.
   *Put to your books when you come home.

2. The boy ran to the car that was waiting.
   *The boy ran among the car that was waiting.

3. The plane flew above the clouds.
   *The plane flew for the clouds.

4. The train pulled into the station.
   *The train pulled on the station.

5. The robber returned to the scene of the crime.
   *The robber returned on the scene of the crime.

6. The boy walked through a puddle.
   *The boy walked at a puddle.

Written

1. The boy swam to the end of the pool.
   *The boy swam with the end of the pool.

2. The girl stared at the sky at night.
   *The girl stared with the sky at night.

3. The boy met the girl at the park.
   *The boy met the girl to the park.

4. The baseball player went back to first base.
   *The baseball player went back with first base.

5. The girl was happy to live in America.
   *The girl was happy to live at America.

6. He marched with the band in a parade.
   *He marched with the band on a parade.

Reflexive Pronoun

Oral

1. The boy saw himself in the mirror.
   *The boy saw herself in the mirror.

2. The girl ate by herself at lunch.
   *The girl ate by himself at lunch.

3. The girl rode the bike by herself.
   *The girl rode the bike by itself.

4. The boys walked by themselves to school.
   *The boys walked by ourselves to school.

5. The girl found the key by herself.
   *The girl found the key by itself.

6. They talked about themselves to the girl.
   *They talked about herself to the girl.

Written

1. The man carried the hammer by himself.
   *The man carried the hammer by myself.

2. The girl stands by herself in the room.
   *The girl stands by himself in the room.

3. Her dog hurt itself running in the street.
   *Her dog hurt myself running in the street.

4. We went to the movies by ourselves.
   *We went to the movies by themselves.

5. We swam by ourselves in deep water.
   *We swam by themselves in the deep water.

6. The girl walked by herself to school.
   *The girl walked by itself to school.

Articles

Oral

1. The pilot turned to the north.
   *The pilot turned to north.

2. The girl put on the warmest coat.
   *The girl put on warmest coat.

3. The girl lost all of the baseball cards.
   *The girl lost all of baseball cards.

4. The boy knew the way home.
   *The boy knew way home.

5. He eats some of the ice cream.
   *He eats some of ice cream.

6. Is there any of the cake left?
   *Is there any of cake left?

Written

1. The phone was knocked on the floor.
   *The phone was knocked on floor.

2. We lived in the house for many years.
   *We lived in house for many years.

3. The girl climbed all the stairs.
   *The girl climbed all stairs.

4. The boy spends part of the money.
   *The boy spends part of money.

5. They live in the old house there.
   *They live in old house there.

6. Many of the schools closed because of snow.
   *Many of schools closed because of snow.

APPENDIX E

SYNONOMY TASK SENTENCES

NRP

Oral

1. The doll is washed in the tub by the girl.
   The girl washes the doll in the tub. (s)
   The doll washes the girl in the tub. (ns)
2. The hat is put on the head by the man.
3. The toy is thrown on the floor by the boy.
4. The wagon is pushed down the road by the boy.
5. The rabbit is splashed in the face by the cat.
6. The car is chased down the road by the dog.

Written

1. The car is cleaned with a cloth by the boy.
2. The bat is swung at the ball by the girl.
3. The car is hit on the road by the deer.
4. The food is cooked on the stove by the boy.
5. The fence is broken near the barn by the horse.
6. The house is painted with a brush by the man.

RP

Oral

1. The horse is kicked in the leg by the cow.
   The cow kicks the horse in the leg. (s)
   The horse kicks the cow in the leg. (ns)
2. The dog is bitten on the nose by the cat.
3. The child is hugged in the morning by the mother.
4. The boy is washed in the tub by the girl.
5. The rabbit is splashed in the face by the cat.
6. The boy is pushed off the chair by the girl.

Written

1. The coat is covered on the chair by the dress.
2. The father is kissed in the evening by the boy.
3. The horse is pulled down the road by the cow.

4. The lion is scared from the forest by the bear.
5. The boy is helped with the work by the girl.
6. The cat is chased around the barn by the dog.

SO

Oral

1. The tiger that the bear hugs climbs up the ladder.
   The bear hugs the tiger and the tiger climbs up the ladder. (s)
   The bear hugs the tiger and the bear climbs up the ladder. (ns1)
   The tiger hugs the bear and the tiger climbs up the ladder. (ns2)
2. The dog that the rabbit pulls runs around the barn.
3. The dog that the cat chases rolls the ball.
4. The cow that the horse bites pushes the wagon.
5. The monkey that the dog pushes touches the ladder.
6. The cow that the horse kicks knocks over the pail.

Written

1. The cow that the horse pushes throws the pail.
2. The monkey that the lion pulls breaks the bottle.
3. The tiger that the zebra kicks eats the apple.
4. The cat that the dog bites rolls the barrel.
5. The bear that the lion hugs sits on the rock.
6. The dog that the rabbit chases carries a box.

OS

Oral

1. The goat kicks the donkey that touches the ladder.
   The goat kicks the donkey and the donkey touches the ladder. (s)
   The goat kicks the donkey and the goat touches the ladder. (ns1)
   The donkey kicks the goat and the donkey touches the ladder. (ns2)
2. The lion hugs the monkey that pulls the wagon.
3. The monkey pulls the lion that knocks over the bucket.
4. The rabbit chases the cat that picks up the bucket.

5. The lion bites the tiger that pushes the wagon.
6. The dog pushes the cat that rolls the ball.

Written

1. The lion chases the tiger that rolls the barrel.
2. The zebra pushes the lion that sits on the rock.
3. The horse pulls the zebra that breaks the bottle.
4. The horse kicks the cow that throws the pail.
5. The rabbit bites the cat that eats the apple.
6. The cow hugs the bear that carries the box.

OO

Oral

1. The lion pushes the bear that the ball hits.
   The lion pushes the bear and the ball hits the bear. (s)
   The lion pushes the bear and the ball hits the lion. (ns1)
   The bear pushes the lion and the ball hits the bear. (ns2)
2. The cow kicks the zebra that the water splashes.
3. The tiger hugs the lion that the ladder touches.
4. The lion pulls the tiger that the hay covers.
5. The rabbit chases the bear that the wagon bumps.
6. The lion bites the monkey that the rain wets.

Written

1. The lion hugs the bear that the fan cools.
2. The cow chases the horse that the blanket covers.
3. The bear pushes the lion that the bat hits.
4. The tiger pulls the zebra that the bush scratches.
5. The donkey kicks the horse that the bottle hits.
6. The cat bites the dog that the barrel pushes.

Direct Object-Complement

Oral

1. The rabbit bites the cat after hitting the ball.
   The rabbit bites the cat and then the rabbit hits the ball. (s)

The rabbit hits the ball and then the cat bites the rabbit. (ns1)
The cat hits the ball and then the rabbit bites the cat. (ns2)

2. The lion pushes the tiger after running home.
3. The horse kicks the cow after drinking the water.
4. The lion hugs the bear after climbing up the ladder.
5. The cow pulls the horse after rolling the ball.
6. The bear chases the tiger after throwing the pail.

Written

1. The cat bites the dog after breaking the bottle.
2. The lion hugs the bear after eating the apple.
3. The cow chases the horse after carrying the box.
4. The lion pushes the bear after rolling the barrel.
5. The monkey pulls the lion after splashing the water.
6. The zebra kicks the cow after sitting on the rock.

Locative Prepositional Phrase-Complement

Oral

1. The dog crawls behind the cat after pulling the wagon.
   The dog pulls the wagon and then the dog crawls behind the cat. (s)
   The dog pulls the wagon and then the cat crawls behind the dog. (ns1)
   The cat pulls the wagon and then the dog crawls behind the cat. (ns2)
2. The rabbit hops behind the cat after throwing the pail.
3. The cat runs from the dog after chasing the ball.
4. The horse stands near the cow after drinking the water.
5. The lion sleeps near the bear after climbing up the ladder.
6. The cow plays behind the horse after knocking over the pail.

Written

1. The monkey hops behind the dog after breaking the bottle.
2. The tiger walks to the lion after drinking the water.

3. The dog swims near the cat after splashing the water.
4. The cow sits near the horse after carrying the box.
5. The lion falls behind the bear after rolling the barrel.
6. The rabbit hides behind the cat after swimming in the lake.

APPENDIX F

SYNONOMY TASK

Order of Stimuli Presentation

T = Target Sentence
S = Synonomous Sentence
NS_1 = Non-synonomous Sentence, variation #1
NS_2 = Non-synonomous Sentence, variation #2

Passives (Non-Reversible and Reversible)

Group 1 & Group 2	Group 3
Sentences:	Sentences:
#1-3 T+S (NRP & RP)	#1-3 T+NS (NRP & RP)
#4-6 T+NS (NRP & RP)	#4-6 T+S (NRP & RP)

Relative and Complement Clause Sentences

Group 1	Group 2	Group 3
Sentence #1 & 4	Sentence #1 & 4	Sentence #1 & 4
Type T+S	Type $T+NS_1$	Type $T+NS_2$
Sentence #2 & 5	Sentence #2 & 5	Sentence #2 & 5
Type $T+NS_1$	Type $T+NS_2$	Type T+S
Sentence #3 & 6	Sentence #3 & 6	Sentence #3 & 6
Type $T+NS_2$	Type T+S	Type $T+NS_1$

APPENDIX G

PLANNED RANDOMIZATION FOR THE ORAL WELL-FORMEDNESS TASK

Order of Correct/Deviant Sentence Presentation Beginning with the Same Puppet:

C = Correct Sentence
D = Deviant Sentence
Total Number of Sentences = 30

Sentence #	Block 1	Block 2	Block 3	Block 4
1	C,D	D,C	D,C	C,D
2	D,C	C,D	D,C	D,C
3	D,C	C,D	C,D	D,C
4	C,D	D,C	D,C	C,D
5	D,C	C,D	C,D	D,C

Sentence #	Block 5	Block 6
1	D,C	C,D
2	C,D	D,C
3	C,D	C,D
4	D,C	C,D
5	C,D	D,C

APPENDIX H

ORDER OF TASK PRESENTATION BY GROUP

Group 1:

Session 1: Oral Comprehension + Conservation Task

Session 2: Oral Synonomy + Written Well-Formedness

Session 3: Written Comprehension

Session 4: Written Synonomy + Oral Well-Formedness

Group 2:

Session 1: Oral Synonomy + Written Well-Formedness

Session 2: Written Comprehension

Session 3: Written Synonomy + Oral Well-Formedness

Session 4: Oral Comprehension + Conservation

Group 3:

Session 1: Written Comprehension

Session 2: Written Synonomy + Oral Well-Formedness

Session 3: Oral Comprehension + Conservation

Session 4: Oral Synonomy + Written Well-Formedness

APPENDIX I

HSU'S GUIDELINES FOR CLASSIFYING ACCORDING TO GRAMMATICAL ORIENTATION AND EMERGENCE OF C-COMMAND (1981) (Based on a maximum of 12 responses per sentence type)*

Responses for Grammar Types

A) Subject Responses for the Direct Object Complement

1. Minimum of 9 subject responses for subject orientation
2. Maximum of 3 subject responses for object orientation
3. 4-8 subject responses for mixed**
4. Minimum of 9 subject responses for adult orientation

B) Object Responses for Direct Object Complement

1. Maximum of 3 object responses for subject orientation
2. Minimum of 9 object responses for object orientation
3. 75% of the remainder of responses should be object responses for mixed orientation**
4. Maximum of 3 object responses for adult orientation

C) OS Relative Clause Responses

1. Subject orientation - minimum of 66% subject responses(8)
2. Object orientation - minimum of 66% object responses(8)
3. Mixed orientation - minimum of 66% object responses(8)
4. Adult orientation - minimum of 9 object responses

D) C-Command - Correct Responses for Locative Prepositional Complements

1. 0-3 = No C-Command (not emerged)
2. 4-6 = Low C-Command Score
3. 7-9 = Developing C-Command Score
4. 10-12 - Reliably Emerged C-Command Score

*Hsu's guidelines are based on a maximum of 6 responses per sentence type.

APPENDIX J

HAKES' GUIDELINES (1980) FOR CLASSIFYING CONSERVATION SCORES

Conservation Level	Number of Correct Responses	
	Behavior	Explanation
Preconserver	1	0
Transitional	*2-5	1-4
Conserver	6	5

*Hakes defined Transitional Conservers as giving "intermediate performances," p. 61.

APPENDIX K

ACADEMIC TEST SCORES, CONSERVATION AND GRAMMAR TYPE CLASSIFICATION FOR READING DISABLED SUBJECTS

	Subject #	Word Analysis	Reading Comp.	Achievement Test	I.Q.	Cons.	Gr. Type
RD 7/8	1	2.4 W		M 1.4	97	5	U + D
	2	2.0 W		M 1.9		9	U + L
	3	3.2 I	2.2 I			7	M + D
	4	1.6 W		M 1.9	105	8	O + D
	5	2.7 W	1.3G-M	M 2.5	101	11	A + R
	6	1.5 W		M 1.9	91	11	M + D
	7	2.6 W		M 2.2		3	O + L
	8	3.2 W	1.9G-M	M 2.3	90	9	U + D
	9	2.6 W	2.0GR		97	2	M + D
	10	3.8 W	2.5G-M	M 2.5	93	4	M + D
RD 9/10	1	2.4 W	2.4G-M	M 2.7	95	10	M + D
	2			M 1.3	10.5P	9	M + N
	3	2.1 W		M 2.0	116	12	M + D
	4	3.1 W		M 2.8	92	12	A + R
	5	4.5 W	5.2G-M	M 9.1	114	12	S
	6	3.4 W	2.5G-M	M 3.3	104	12	M + R
	7	2.5 W	4.6 I			10	U + D
	8	7.2 W	3.6G-M	M 5.0	97	10	M + R
	9	2.9 W	3.2G-M		91	11	M + R
	10	6.2 W	2.3G-M	M 5.0	90	11	O

Blank space = no score was reported.

Reading Tests: M = Metropolitan Achievement Test; SP = Spache Diagnostic Reading Test;

Reading Tests - Cont.: G-M = Gates-McGinitie Test of Reading Comprehension; GR = Gray Oral Reading Test; I = Iowa Test of Basic Skills; W = Wide Range Achievement Tests; P = Peabody Picture Vocabulary Test-(Mental Age); Cons. = Goldschmid-Bentler Test of Conservation.
Grammar Types: S = Subject oriented; O = Object oriented; M = Mixed subject-object oriented; A = Adult orientation; U = Unclassifiable.
C-Command: N = No C-Command; L = Low C-Command; D = Developing C-Command; R = Reliably high C-Command.

APPENDIX L

SENTENCE COMPREHENSION
INSTRUCTIONS TO SUBJECTS

First review all the toy animals and objects. Then say: "I'm going to read sentences to you;" (In the written task say: "You're going to read sentences out loud"). "Then I would like you to use the toys and make them do what the sentence says. I'll repeat each sentence for you again so that you'll remember it." (In fact, sentences were repeated at least 3 times. If subjects asked for additional repetitions, they received them). "Okay, are you ready?"

APPENDIX M

SYNONOMY TASK INSTRUCTIONS

"I'm going to read some sentences to you. You'll listen to two at a time. Sometimes the sentences will mean the same thing (example given); sometimes they'll mean different things (example given).

You tell me if each group of sentences that you hear (or read) means the same thing or different.

I'll say the sentences to you a few times." (In the reading portions, subjects could re-read the sentences as many times as was necessary. Instructions and examples were repeated if subjects did not understand the task).

APPENDIX N

WELL-FORMEDNESS TASK INSTRUCTIONS

Two puppets (Sylvester the Cat and The Wise Old Owl) were used.

"You're going to hear 2 sentences. One of the sentences is correct; it's a good sentence. The other is incorrect; you know, it's silly and said wrong.

Let's pretend that sometimes Sylvester (point to puppet) and sometimes the owl (point to puppet) are saying these sentences. You show me the one who said the wrong sentence. Remember, sometimes the owl will be wrong and sometimes Sylvester will be wrong. I'm going to ask you why you thought the sentence was wrong."

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