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The Implications of Different Language Comprehension Strategies in Learning Disabled Children : Effects of Thematization

by

GERALDINE P. WALLACH

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

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ABSTRACT

The semantic aspects of the comprehension process and the language component of learning disabilities are two areas of research receiving much attention in the 1970's. Sentences are no longer being considered as isolated linguistic entities but the study of sentences remains an important aspect of psycholinguistic research. Investigators continue to provide information about the comprehension strategies available to listeners. Some report those strategy differences manifested by LD (learning disabled) children providing additional dimensions to the study of comprehension. Also being discovered is that ongoing comprehension is affected by a listener's prior knowledge of the world and/or the previous information awaiting each incoming sentence (Bransford and Johnson, 1973). Indeed, the complex relationship between comprehension and memory systems is a focal point for many discussions.

Investigators have begun to describe the syntactic, semantic, and listener variables which affect the way incoming information is organized. The general tendency of listeners to search for themes, or some inherent organization within newly-given information, has been reported by many (i.e., Bransford and Johnson, 1973; James et. al., 1973; Thorndyke, 1975). Recently,

Perfetti and Goldman(1975) have stressed the important function of thematization for organization, recall, and comprehension of connected discourse.

With the above points in mind, this study was undertaken to: 1) gain additional insight into the language-organizational difficulties of LD children in terms of their use or non-use of comprehension strategies; 2) to contribute information regarding the differential effects of given contextual information upon sentence comprehension in both learning disabled and normally achieving children between the ages of 8:6 and 13:9. A series of three experiments was conducted to investigate a wide range of processing and listener variables: the comprehension of four types of relative clause sentences were compared in view of individual processing abilities (Experiment 1) and in light of thematized and non-thematized prior contexts (Experiment 2). Tests of free recall for word lists and digit span (Experiment 3) were included to provide supplementary information about short-term memory factors and spontaneous categorization (clustering) as a strategy for word list recall.

Quantitative and qualitative results in Experiment 1 differentiated normal and learning disabled children. Additionally, two main LD language processing subgroups were isolated: LD-Strategy Users were defined by their ability to formulate consistent strategies in their attempts to understand sentences; LD-Inconsistents were defined by their general inability to form and consistently apply

comprehension strategies.

Experiment 2 provided information about on-line sentence comprehension as it is affected by context. The contexts were paragraphs which were either thematized or non-thematized. The results supported a relationship between the specific semantic structure of a prior context and immediate sentence processing while reaffirming that this relationship is a complicated and indirect one. The effects of thematized and non-thematized contexts on the individual sentences were neither uniform upon all children nor were they the same for all sentence types. While the comprehension of subject relatives was differentially affected by the presence of subject (facilitating) and object (non-facilitating) story-themes, this effect was not obtained with the object relatives. The reasons for these differences are clarified when viewed in relation to existing listener strategies, the semantic matching of thematized and sentence referents, and the different information required to comprehend each sentence type.

The results of Experiment 3 support the interaction of short-term memory factors with comprehension difficulties especially in the case of LD-Inconsistent children.

The general findings of this study emphasize the significance of grouping learning disabled children by strategy abilities. The implications of thematization as

a construct for future research and the need for evaluating the available testing and training procedures for learning disabilities are briefly discussed.

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Dean Norma Rees presented me with ideas which formed the basis for studying thematization in relation to sentence comprehension. She contributed countless new ideas and suggestions as the project continued. Her interest and encouragement gave me the knowledge and the confidence to observe the language problems of learning disabled children in a more innovative way.

Dr. Joel Stark remained the driving force behind this research. His philosophy, confidence, and support through the entire development of this study helped me to continue when its completion seemed impossible. His insights into language-learning disabled children kept the purpose of this research in perspective and taught me to understand the importance of relating theory to clinical application.

Dr. Helen Cairns, the Chairman of this committee, cannot be thanked enough for the endless number of hours she personally contributed toward the completion of this dissertation. Her perserverance and boundless energies were remarkable from the inception of the idea for this study to its final draft. Her enthusiasm, interest, and sensitivity contributed not only to the quality of this project but also to my professional and personal growth. The knowledge which she so freely shared and the time which she so willingly gave to me will always be remembered and appreciated.

Some of those individuals who also contributed in some specific way to this project include the following: Dr. Harry Levitt and Mr. Harvey Stromberg for their advice and assistance with the statistical analyses; Dr. Irving Hochberg and Dr. Katherine Harris for their suggestions and their encouragement; Mr. Richard Allison, Director of the Horizon School, Flushing, New York, for his support of this research and for making available to me the learning disabled subjects of this study; Mr. Kramer and Mrs. Schuster of the Croyden School, Jamaica, New York, for graciously allowing me to test the normally achieving children of this study.

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TABLE OF CONTENTS

LIST OF TABLES

Table | Page

"Language cannot really be taught, but can only be awakened in the mind; one can only offer the thread along which language develops on its own (vonHumboldt, 1836; quoted by Chomsky, 1964, p. 57)."

Chapter 1

The Problem

Three areas of research -- learning disabilities, comprehension strategies, and information processing -- are being discussed by professionals in many fields. Though not easily separated, these areas are not necessarily being studied in conjunction with one another. The task of language analysis becomes, in a sense, even more difficult when the researcher attempts to define, isolate, and discuss the linguistic system of children who show differences and/or delays on some part of the language continuum and up through the different levels of the processing hierarchy (phonological-lexical-syntactic-semantic).

With the reassessment of the competence-performance distinction through the late 1960's and 1970's, researchers in both adult and developmental psycholinguistics are attempting to characterize the set of heuristics or specific comprehension strategies which underlie the performance of listeners (and speakers). As Fodor(1971) has argued, "the mental operations which underlie the behavior of the speaker/hearer are not identical to, and probably do not include, the grammatical operations involved in generating sentences [p. 134]." However,

he goes on to say, "The grammar...(expresses)... the information upon which the recognition heuristics capitalize (Fodor, 1971, p. 134)."

Language comprehension includes many different processes. This enables researchers to study the interrelationships among sentential complexity, hearer strategies, prior context, and normally acquiring and/or language disordered children. The complicated transformation from auditory signal to message involves stages of processing which are both simultaneous and successive so that the process of language comprehension is revealed as being extremely complex (Studdert-Kennedy, 1974).

Listeners, when faced with incoming sentences, not only use their knowledge of linguistic rules but also use their knowledge of the world and prior experience in order to understand sentences (Bransford and Johnson, 1973). Thus, a complete understanding of comprehension goes beyond characterizing the linguistic-perceptual system per se to include that information in the mind of the listener awaiting the arriving sentence, contributions made by listeners themselves, and available extralinguistic or contextual information.

"Comprehension of a message," writes Carroll(1972), "is adequate or satisfactory to the extent that the language receiver apprehends...whatever linguistic information is present in the message and is able to relate that information to whatever context is available at a given time[p. 13]." And Harris(1974), reinforcing the above statements, says, "It is clear that theories of sentence processing must recognize that linguistic input is interpreted in light of its context and the stored memory representations and thought processes activated by the sentence[p. 636]."

Thus, as more research is done, information relating individual sentence processing to semantic input, memorial and comprehension processes, listener strategies and comprehension success,is accumulated. Clearly, available comprehension strategies can affect how a sentence is interpreted, and perhaps, how it is stored in memory; likewise, memory processes may affect comprehension ability (Just and Carpenter, 1976).

For the most part, adult listeners analyze and comprehend messages quickly and, seemingly, effortlessly. Proficient language users have strategies for chunking incoming sentences which are competency-based. In other words, their knowledge of linguistic rules enables them to use both grammar and strategies to understand sentences.

For young children acquiring language and for learning disabled children, who do not have a complete knowledge of the grammar, comprehension may be much more difficult. Their comprehension strategies, unlike those employed by adults, are non-competency based.

Bever(1970), Ervin-Tripp(1970), Slobin(1970), Chomsky(1969), Cromer(1971), Amidon and Carey(1972), and Sheldon(1973), to name only a few, have studied the development of comprehension strategies in children. These researchers, among others, outline developmental progressions of children from use of more basic canonical order strategies, to clausal strategies, to lexical strategies, up through use of more complex and subtle-supplementary methods of sentence analysis.

It is also important to investigate the comprehension strategy differences which exist between normally achieving and learning disabled children. Indeed, comparing the processing systems of these two groups of children may increase our understanding of the role of comprehension in thinking, learning, and memory disabilities. Too, studying sentence comprehension as it is affected by prior context may provide more information about the complex relationship between memory and comprehension systems.

Reason for the Study

Part one

The complex relationships among language and thinking, mental development and strategy formulation, and information integration and retrieval are presently becoming topics of focus regarding the language component of learning disabilities. The learning disabled child, still a mystery in many ways, has been described as minimally brain-damaged, perceptually impaired, dyslexic, emotionally disturbed, slow, and more recently, language-learning disabled. Many researchers including deHirsch(1952), Wepman(1960), Johnson and Myklebust(1967), Stark(1967), and Berry(1969), for example, have previously discussed the language systems of learning disabled children. Within the past five years, however, interest in the particular nature of their language disabilities has been renewed and modified in light of some newer concepts relating to strategy development and like issues.

It would be difficult to continue to discuss these special children without mentioning the past (and sometimes present) emphasis upon perceptual testing and training as a major educational concept for learning disabilities. From the early foundations of Strauss and Werner(1938) and due to the prevalence of reading

disabilities in learning disabled children, the terms perceptually impaired (visually perceptually impaired) and learning impaired frequently became used as synonyms for each other. By visually perceptually impaired, people often meant, "The learning disabled child does not see, sequence, and/or discriminate written stimuli in the correct way -- the way an intact neurological system enables normally achieving children to decode those written characters on the page."

More specifically, the visual perceptual orientation was laid down from evidence accumulated by Strauss and Werner(1938). These researchers observed perceptual-motor pattern differences exhibited by mentally retarded (MR) children. Endogenous MR's copied Bender-Gestalt geometric designs as normals and exogenous MR's went about their constructions in an entirely different manner. The exogenous group, manifesting perceptual-motor differences, believed due to neurological (as opposed to genetic) deficits, became a subgroup within the MR complex with particular behaviors. Strauss and Werner(1938), then, destroyed the popular notion of a homogeneous MR population and the field of learning disabilities developed from their work. Strauss and Lehtinen(1947), Kephart(1960), Frostig(1964), and Getman(1965), to name only a few, continued to emphasize the training of visual processes as a forerunner or

prerequisite for higher level learning.

As indicated, researchers such as Johnson and Myklebust(1967), Monroe(1932), Robinson(1952), and Kirk and Kirk(1971), among other early investigators, discussed language factors relating to learning and reading disorders. However, auditory perceptual processing rather than linguistic processing was frequently the emphasis. It was believed that skills such as the sequencing and the discrimination of isolated sounds or words, with emphasis upon listening, would provide an alternative to visual training for the learning disabled child.

Presently, researchers such as Hammill(1972), Zack and Kaufman(1972), Smith and Marx(1972), Rees(1973), Stark(1975), and Larson, et. al.(1976) point out the inadequacies of both visual and auditory "perceptual deficit" as a global-educational concept for learning disabilities. They also question the usefulness of available perceptual testing and training tools. Thus, the search for theoretical, clinical, and educational alternatives continues.

Whatever one's particular orientation happens to be, there is nevertheless this population of children who are having difficulties learning in regular classroom settings, who are frequently falling behind in their work (noticeably around Grade 2 or 3) and who,

in more cases than not, are becoming increasingly frustrated by peer, parent, and teacher pressures.

Koppitz(1971) chronicles the five-year history of the first 177 children admitted to a new learning disabilities program. She writes that "A child is said to have a learning disability if his school achievement is more than one year below his mental age and if he cannot get along or profit from attending in a regular public school class despite normal intellectual potential (i.e., an absence of mental retardation) and lack of gross motor-impairment [p. 1]."

In an earlier work, Johnson and Myklebust(1967) also defined learning disabilities. They indicated that this group is homogeneous if they "manifest integrity emotionally, motorically, sensorially, and intellectually, but despite these integrities...cannot learn in the usual or normal manner... though ...the children with learning disabilities might also have minor motor incoordinations as well as a degree of emotional disturbance [p. 9]. "

Eisenson(1972) discusses developmentally aphasic children under the broad category of "minimal brain dysfunction." He indicates:

> "The syndrome of minimal brain dysfunction refers to children who are not mentally retarded and who may, in fact, be near average or even above average in intellectual potential, but who present deviations in perceptual functioning, in conceptualization, in severe delay in language development, in attention, and memory. But since all these deviations are not necessarily present in all children, it is not a fixed and altogether stable syndrome [p. 70]."

Thus, an endless number of definitions appear in the literature, in governmemtal documents, and in the minds of educators. In summarizing a description, particularly representative of the population of this study, Bateman(1965) has written that children with specific learning disabilities are those who:

> "manifest an educationally significant discrepancy between their estimated intellectual potential and their actual level of performance...related to basic disorders in the language processes...which may or may not be accompanied by demonstrable nervous system dysfunction and which are not secondary to a general mental retardation, educational or cultural deprivation, severe emotional disturbance, or sensory loss. [p.229] ."

A satisfactory definition still places all learning disabled children into a broad category. Many researchers, aware of this problem, have tried to discover some of the homogeneous factors which would be reliable for developing learning disability subgroups. They hope that more appropriate testing and teaching methods will be a consequence of such research. They also believe that some of the statements made about learning disabled children are too presumptive, i.e., learning disabled children manifest minimal brain-dysfunction.

Investigators have attempted to group learning disabled children on the basis of WISC IQ verbal-performance

discrepancies(i.e., Reitan, 1974; Rourke, Dietrich, and Young, 1973), attentional deficits(i.e., Rourke and Czudner, 1972), lateralization effects(i.e., Rourke, Yanni, et., al., 1973), and academic performances(i.e., Doehring, 1968). Rourke(1975) indicates that while it is difficult to find a completely clear-cut pattern of performance among learning disabled children, the strategy behind this type of investigation for composing learning disability subgroups is important. For example, Rourke(1975) reports that certain psychological measures (i.e., IQ or visual-auditory perceptual tests) may be powerful discriminators of learning disabled and normal children only in the early school ages (6-to-8-year-old). Likewise, tests of attention, including auditory and visual reaction times, may only be sensitive to differences in the younger age ranges. Rourke and Czudner(1972) indicate that the performances of younger learning disabled children on tests of auditory and visual reaction times differentiated them from their normal age counterparts. On the other hand, the performances of older learning disabled children (9-to-14-year-old) on these tests of reaction time did not differ from the performances of their normal age mates.

Researchers have not talked about the comprehension strategy differences which exist among learning disabled children. The present study provides information which

was previously unavailable. Learning disabled children were grouped on the basis of their ability to formulate strategies for understanding complex sentences. Their particular performances on an individual sentence comprehension task were considered in relation to other information processing and test results. If, in fact, comprehension strategy patterns relate to more general mental capacities or learning styles then more consolidated information about learning disabled children could be established. The identification and further study of the language comprehension subgroups which are found to exist within the learning disability population may provide new directions for research.

Part Two

In addition to studying the comprehension strategy differences which exist among learning disabled children, information relating to the complex interaction between comprehension and memory systems is also of interest here.

A study of comprehension, in a sense, includes a study of memory. Perfetti and Goldman(1976) put it this way: "A language-specific memory function beyond mere short-term memory capacity appears to be an important component of comprehension skill [p. 33] ." It is

agreed by researchers that listeners do not store sentences verbatim. Thus, an important focus of current investigations relates to the components which do remain in memory.

Perfetti and Goldman(1974; 1975) discuss the concept of thematization in relation to sentence and story memory. They write, "The primary function of thematization is to provide a referential core around which propositional information concerning the referent is organized(Perfetti and Goldman, 1975, p. 257)." In a sense, then, when the listener establishes (in his own mind) the main character or focus of a sentence or a story, he has provided for himself a "conceptual peg" around which other information can be built (Paivio, 1971). James, Thompson, and Baldwin(1973), James(1972), and Halliday(1967) also support this notion that listeners organize sentences around a theme or a central character. James, Thompson, and Baldwin(1973) indicate, "A sentence is stored as a semantic bundle having a theme and a preserving logical relations among the words [p. 61] ."

The present study is based upon the following basic assumptions about language processing:

1. Sentence comprehension is an active and constructive process involving an interplay between linguistic and extralinguistic variables.

2. The comprehension of a sentence may be affected by the nature of prior context and previously existing information in long-term storage.

3. The semantic representation of a sentence(or a group of sentences) in memory is abstract and syntax free.

4. A study of the qualitative differences of the language comprehension strategies employed by learning disabled children through a variety of tasks will provide a broader conceptual base for increasing our understanding of language-based learning disabilities. Analyses of quantitative results alone may be helpful in only a very limited way.

There are numerous ways to study the syntactic, semantic, and memory variables involved in the comprehension of sentences and stories. This study will examine these variables mainly in terms of the effects of thematization and context.

The Present Research. In the first part of this study, observed comprehension strategies on an individual sentence processing task were revealed. Particular emphasis was placed upon the qualitative nature of the strategic errors made by both learning disabled and normal children in the absence of any prior context. In the second part of this study, the effects of context on sentence comprehension was investigated in the

following way: Children were presented with thematized and non-thematized stories before hearing a complex sentence. Thematized stories were paragraphs which contained a central or main character; non-thematized stories were paragraphs which did not contain a main character. With this technique, it was possible to gain additional insight into the way prior information affects a listener's perception about the relations contained in the stimulus sentence.

In view of the assertions already made and the possible differences between learning disabled and normal children, the following hypotheses were tested:

1. The comprehension strategies of learning disabled children will quantitatively and qualitatively differ from those strategies employed by normally achieving children.

2. It will be possible through a complex sentence processing task to differentiate a limited number of subgroups within the LD population. Some LD children will manifest an ability to consistently apply comprehension strategies. Other LD children will not manifest an ability to consistently apply comprehension strategies. It is predicted that these processing differences will continue to manifest themselves in other types of language and memory performances.

3. A relationship between semantic information stored in memory and immediate sentence processing will be revealed. Specifically, comprehension and organization of relations within a sentence will be affected by thematization.

4. A relationship between the ability to use strategies and the ability to integrate given information will be demonstrated. Prior context will have a greater effect upon the normals and consistent strategy formulators than it will have upon any inconsistent subgroup within the LD population.

Part Three

One of the many problems that arises when attempting to characterize the comprehension strategies of disordered children is to relate the performance on an isolated psycholinguistic task to other performances (indicated in Hypothesis 2). In order to provide some supplementary information relating memory systems and processing abilities, two short-term memory tasks--free recall of word lists and digit span--were included in a third part of this study.

Of particular interest here is the concept of clustering. As first described by Bousfield(1953), this is the characteristic in free recall whereby subjects tend to group words by category, utilizing an unconscious cognitive strategy. Recall, then, can be facilitated if the subject constructs the lists'

inherent organization (Tillman, 1975). Thus, the consideration of clustering, as a strategy, provides an additional facet of the memory and comprehension strategy relationship. By presenting clusterable and non-clusterable word lists, subjects' performances were viewed in light of their performances through Experiment 1 and Experiment 2 of this study.

The ever-present discussion of the digit span performances of learning disabled children mirrors some of the points already made regarding perceptual processing. Denchla(1972), Kirk and Kirk(1971), Guthrie, Goldberg, and Finucci(1972), and Valtin(1973), among others, discuss the pros and cons of trying to relate auditory memory scores for digits to comprehension, reading, and learning disabilities. Indeed, deficits in the auditory memory span for digits may be related to some other memorial factor. However, poor digit span is not necessarily the cause of other language and/or academic problems (Hallahan and Cruichshank, 1973). The results from this part of the study (Experiment 3) are viewed within this framework.

The psycholinguistic, information processing, and learning disabilities literature is quickly expanding. Researchers, educators, and clinicians are being provided with information about the ways in

which proficient and developing language users process, understand, and integrate information in their world. Knowledge about the nature of comprehension and memory systems in normal adults and children is needed before one can begin to understand the disordered population. But as the normal population may aid in our understanding of the disordered population, so, too, the population of learning disabled children may contribute information about normal processing. The concepts and the issues merely introduced to this point will be discussed in the following chapter.

Chapter 2

The Nature of Comprehension and Information Processing

"The major contribution of the study of language," wrote Chomsky in 1968, "will lie in the understanding it can provide as to the character of mental processes and the structures they form and manipulate [p. 66]." According to Miller (1962): "One of the best ways to study the human mind is by studying the verbal system it uses [p. 761]." And, "Learning what different utterances mean is...a fundamental skill that any language user must acquire (Miller, 1962, p. 748)."

Understanding a sentence involves extracting its underlying meaning and the speaker's intent. While terminology and experimental emphasis have changed, the problem of discovering precisely how the listener, given an acoustic stimulus, determines its underlying relations remains a current one (Wanner, 1974, p. 1). An even more controversial base for today's research includes attempts to characterize the nature of information in long-term memory store (e.g., Sachs, 1967; Bever, Lackner, and Kirk, 1969; Bransford, Barclay, and Franks, 1972).

Actual descriptions of semantic representations in the minds of listeners will probably remain vague.

However, much more information is presently available relating to the structural organization of sentential and propositional information in memory (e.g., Thorndyke, 1975; Perfetti and Goldman, 1975; Paivio, 1971; Lachman and Dooling, 1968). Additionally an even clearer understanding of the sound-to-meaning transition has begun to emerge through studies of the comprehension strategies which interact with the listener's covert linguistic knowledge (Fodor, Bever, and Garrett, 1974; Bever, 1970). It is generally agreed that both semantic and psychological factors are required to explain certain results obtained in sentence comprehension (Slobin, 1966).

A Model of Sentence Comprehension

A theory of sentence processing, resulting after about sixteen years of psycholinguistic research, is considered to include a number of general stages: recognition and preliminary search; lexical retrieval and structural analysis; integration of lexical and structural information; semantic interpretation of the appropriate sentoid (Cairns and Cairns, 1976; Studdert-Kennedy, 1974; Gough, 1972).

A complete model of sentence comprehension includes within its theoretical framework the two following ideas:

First, any proposed levels or stages represent examples of overlapping, and in some cases, parallel processes. Clear, step-by-step progressions from one stage to the next are not necessarily indicated. Second, the analysis of individual sentences should be viewed in light of their integration with the prior knowledge or the information already in the mind of the listener. With these few points in mind, the comprehension process will now be explored in greater detail.

Recognition and Preliminary Analysis

A sentence reaches the ears of a listener as a signal in the raw form of an acoustic stimulus. Beyond voluntary control, the acoustic stimulus is transformed into an auditory-neurological "event" including such characteristics as frequency, intensity, and duration -- or, in psychological terms, pitch, loudness, and length. Through phonetic and phonological stages, a listener abstracts the phonemes of his language from the initial auditory stimulus (Studdert-Kennedy, 1974). The language comprehension system provides quick and efficient processing of individual sounds (as listeners make predictions based upon their knowledge of the language). As a result, "speech can be followed...at rates as high as four hundred words per minute...about thirty phonemes per second (Liberman, Cooper, et., al., 1967, p. 432)." Thus, recognition, as used here, refers to a more basic perception

of the acoustic signal as language and describes the earlier stages of the comprehension process. Lexical, syntactic, and semantic analysis complete the final transformation of signal to message.

Lexical and Structural Analysis

As lexical items are received, the listener scans, chunks, and analyzes the important information. As proposed by Gough(1972), Kimball(1973), and Fodor, Bever, and Garrett(1974), to name only a few, a primary-working-short-term memory system interacts with the language comprehension system by retaining and dismissing specific material when appropriate. As information about each lexical item is retrieved from long-term store, it is placed in working memory (a buffer zone of limited capacity) until at least one plausible structural analysis is made. Working memory is then cleared as lexical and structural integration takes place. The result of this is a semantic interpretation and loss of the explicit lexical and syntactic information previously utilized by the hearer (Cairns and Blank, 1975).

Evidence from psycholinguistic research has been accumulated supporting the various aspects of this model. Relating to the perceptual integrity of clauses as units of immediate sentence processing, Fodor and Bever(1965), Garrett, Bever, and Fodor,(1966), Abrams and Bever(1969), and Bever, Lackner, and Kirk(1969), for example, found that

nonspeech interruptions (clicks) tended to be displaced toward clause boundaries. For instance, even when acoustic cues were carefully controlled, subjectively placed clicks tended to be perceptually displaced between "horse" and "is" in sentence (1) below and between "win" and "the" in sentence (2) below.

(1). Your eagerness to win the horse/is quite immature.

(2). In its eagerness to win/the horse is quite immature.

Jarvella(1971) and Caplan(1972) provide further evidence for clausal processing units. Jarvella(1971) contributes information about the accessibility of linguistic details (be they lexical or syntactic) and he also discusses the nature of speech processing units in memory.

By presenting listeners with short stories(e.g., (3) and (4) below) which were interrupted at various points, Jarvella(1971) found that rote recall was best for the clause immediately preceding the interruption.

(3). (A) The tone of the document was threatening.
(B) Having failed to disprove the charges,
(C) Taylor was later fired by the President

(4). (A) The document had also blamed him for
(B) having failed to disprove the charges.
(C) Taylor was later fired by the President.

Items appear to decay clause by clause and specific syntactic or lexical information is not as accesible from memory after clausal and/or sentence processing has occurred. Jarvella(1971) also found, for example, that information from clause (B) was better recalled when that clause was part of the final sentence (example (3)); recall was not as accurate when clause (B) was part of the previously given sentence (example (4)).

In light of his results, Jarvella(1971) concluded:

> "...the most recently heard clause and sentence are organized as speech processing structures in memory; both the sentence being listened to and the immediate clause heard...appear to be differentiated from previous speech as accessible units in memory [p. 415] ."

Caplan(1972) also showed that information is lost over clause boundaries. He presented subjects with a sentence followed by a probe word (after a 100 msec delay). Subjects were asked to indicate whether the word had appeared in the sentence. By carefully controlling acoustic cues and time intervals, Caplan(1972) found that response latencies were shorter when the probe word was taken from the final clause of a sentence ((5) below) than when probe words had appeared in the first clause ((6) below). "Oil" represents the probe word in sentences (5) and (6) below.

(5) Now that artists are working fewer hours, oil prints are rare.

(6) Now that artists are working in oil, prints are rare.

"These results," writes Caplan(1972), "reinforce the hypothesis that clause boundaries are primary units in the segmentation of sentences in perception [p. 75]."

Memory Storage Effects

Sachs(1967) showed a complete loss of syntactic information in memory. She presented subjects with taped paragraphs after which they were given recognition sentences. The subjects were presented these sentences immediately after the passages and after two short time intervals (27 and 46 sec.). They were asked to determine if any of the sentences had appeared in the paragraph and to note any changes in the sentences. Sachs(1967) found that while subjects were about eighty per cent correct in detecting semantic changes in sentences over time, they were much less accurate in detecting syntactic changes. If an active sentence such as, "Gallileo, the great Italian scientist, sent the letter," was changed to, "The letter was sent by Gallileo, the great Italian scientist," this syntactic change tended to go unnoticed as the meaning is intact. Subjects did have some ability to recognize the form of sentences after 27 and 46 seconds, but

it was quite low and contrasted greatly with their memory for semantic content of the sentences (Sachs, 1967, p.441). The memory for syntactic information was best when the sentence was presented immediately after the passage. Sachs' results suggest that the original form of the sentence is stored only for the short time necessary for comprehension to occur (Sachs, 1967, p. 437). Thus, while the memory for meaning persists longer, the memory for specific syntactic and lexical context fades rapidly (Carroll, 1972, p. 7).

Bransford and Franks(1971), Bransford, Barclay, and Franks(1972), and Bransford and Johnson(1973) considered additional processes in memory. These investigators also propose that it is the semantic content of sentences which is remembered. They discuss the semantic integration of sentences and inferential processing in great detail.

Bransford and Franks(1971) demonstrated the tendency of listeners to integrate sentences into a general meaning representation or semantic idea. For example, subjects were told a short story which contained four simple sentences such as (7) - (10) below. During presentation,

(7). The rock rolled down the mountain.

(8). The rock crushed the hut.

(9). The hut is tiny.

(10). The hut is at the edge of the woods.

sentences (7) - (10) were presented in random order and interspersed with other sentences which were not part of the story. The listener, then, had to integrate the sentences in order to get the complete idea.

Five minutes after hearing the story, subjects were tested for recall. They were asked if they recognized any of the sentences given to them by the experimenter. They were also asked to give confidence ratings regarding the sentences. The recognition list contained sentences such as (11) and (12) below. Sentence (11) represents a combination of the four simple sentences (7) - (10). Sentence (12) represents a combination of three of the original sentences, sentences (8), (9), and (10).

(11). The rock which rolled down the mountain crushed the tiny hut at the edge of the woods.

(12). The rock crushed the tiny hut at the edge of the woods.

Bransford and Franks(1971) found that subjects selected sentence (11) with the highest degree of confidence as having appeared before. Sentence (12) was judged with the next highest degree of confidence. Both sentences (11) and (12) had not appeared in the story. These findings provide evidence that subjects quickly forget the specific form of individual sentences.

Too, Bransford and Franks(1971) show that subjects integrate sentences into a more general semantic representation. Subjects recognized sentences according to how well they fit an idea -- or the complete semantic description represented in the story.

Bransford, Barclay, and Franks(1972) further studied inferential processes in memory. They showed that listeners use their knowledge of spatial relations when attempting to comprehend and remember sentences. Bransford, et. al. (1972) presented subjects with lists of sentences including types (13) and (14) below followed by recognition items including types (13)' and (14)' below. The subjects were asked to indicate if they had previously heard any of the recognition items. They

(13). Three turtles rested beside a floating log and a fish swam beneath them.

(14). Three turtles rested on a floating log and a fish swam beneath them.

(13).' Three turtles rested beside a floating log and a fish swam beneath it.

(14).' Three turtles rested on a floating log and a fish swam beneath it.

were also instructed to rate their confidence regarding their decisions. The recognition items ((13)' and (14)') have pronoun substitutions of "it" for "them."

It was found that subjects who had received type (13) quickly and correctly rejected (13)' as having appeared before. On the other hand, subjects who had been given (14) confidently and incorrectly indicated that (14)' had appeared before. Thus, sentences (14) and (14)' were not discriminated from each other after three seconds. Because of inferential processing on the part of listeners, i.e., if turtles are on a log and a fish swims beneath them, it must also swim beneath the log, the meaning of the first sentence (14) becomes integrated into the meaning of the recognition sentence (14)'.

Johnson, Bransford, and Soloman(1973) have also revealed inferential processes of a different type. They considered listeners' tendencies to infer instruments used to carry out acts. Subjects were read stories such as (15) and (16) below. An experimental group was given story (15) and a control group was given story (16). Later both

(15). John was trying to fix the bird house. He was pounding the nail when his father came out to watch him and to help him do the work.

(16). John was trying to fix the bird house. He was looking for a nail when his father came out to watch him and to help him do the work.

groups were presented with a recognition story such as (17) below. They were asked to indicate whether any of the

sentences in the recognition story were changed.

(17). John was using a hammer to fix the bird house when his father came out to watch him and to help him do the work.

Johnson, Bransford, and Solomon(1973) found that the experimental subjects were generally less likely to distinguish previously given sentences (John pounding...) from new sentences plus their implied instruments (John was using a hammer...). These results indicate that the subjects from the experimental group were inferring that John had used an instrument (a hammer) to pound the nail. Thus, the test and the recognition sentences,due to inferential processing on the part of the listeners, became indistinguisable in memory.

A number of researchers have provided information about some of the processes involved in sentence comprehension and sentence memory. It has been shown that while specific syntactic information is quickly lost, the meaning of sentences is retained for longer periods. It has also been demonstrated that listeners use their knowledge of the world when attempting to comprehend and recall sentences.

Adults also employ comprehension strategies when processing sentences. For example, they form hypotheses about the perceptual integrity of word groups(e.g., Fodor and Bever, 1965; Fodor, Bever, and Garrett, 1974). They also

use surface structure cues (e.g., Fodor and Garrett,1967; Hakes and Cairns, 1970) and make logical assumptions about the underlying relations of the various noun-verb-noun sequences (e.g., Bever, 1970). As indicated in Chapter 1, these strategies, or methods for analyzing sentences, are based upon the knowledge of the language in adults. They are competency-based so that adults use both the grammar and strategies to comprehend sentences.

Comprehension Strategies

A number of major and supplementary strategies have been defined throughout the literature (e.g., Fodor, Bever, and Garrett, 1974). As the concept of strategy is an important one for the present study, some of the important comprehension strategies will be outlined here. However, they will be elaborated upon in the discussions of language development and learning disabilities.

The Canonical-Sentoid Strategy. This refers to the primary, perhaps the most basic, method of syntactic analysis used by listeners. With this strategy, the first noun-verb-noun sequence of a sentence is assumed to be the actor-action-recipient of that sequence if there is no clause boundary and if the first verb agrees with the first noun. Bever(1968) describes the persistency of adult listeners to assign a subject-verb-object analysis

to self-embedded sentences such as, "The editor the authors the newspapers hired liked died," with the resulting interpretation, "The editor authors the newspapers." (Fodor, Bever, and Garrett, 1974, p.345).

Wanner and Maratsos(1971) and Walker(1969) report that subject-focus relatives, i.e., a relative clause sentence in which the underlying subject is relativized, were easier to comprehend that object-focus relatives, i.e., a relative clause sentence in which the underlying object is relativized. For example, sentence (18), a subject-focus relative, can be successfully comprehended by application of the canonical-sentoid strategy to the first noun-verb-noun sequence (the girl kissed John). However, the first noun-verb-noun sequence of sentence (19), an object-focus relative,violates canonical order (John kissed the girl).

(18). The girl who kissed John blushed.

(19). The girl whom John kissed blushed.

Baird and Koslick(1974) also offer supportive evidence for the power of the canonical-sentoid strategy. The college students in their experiment recalled subject-focus sentences (such as (18)) more accurately than they recalled object-focus relatives (such as (19)). Baird and Koslick(1974) concluded that some of the difficulties may have been due to canonical-order violations in the object-focus relatives. Hakes, Evans, and Brannon(1976)

also report the tendency of subjects to use the canonical-order strategy for the comprehension and recall of complex sentences. Bever(1970) has shown that passive sentences, such as (20) below, which violate canonical order are difficult for children acquiring language.

(20). The cat was chased by the dog.

Clues in Surface Structure. These strategies, referring to listeners' use of specific information in the surface structure of sentences, are of particular interest when considering complex sentences. Fodor(1971) writes, "The complexity of a sentence increases with decrease in the explicitness with which its surface structure configurations represent its underlying deep structure [p. 131] . Fodor and Garrett(1967), Hakes and Cairns(1970), and Hakes and Foss(1970), measuring paraphrase accuracy and phoneme monitor times, indicate that the elimination of the relative pronoun in sentence (21) increases processing difficulty. The presence of the

(21). The man the girl knew got sick.

(22). The man that the girl knew got sick.

relative pronoun in sentence (22), however, provides the listener with more explicit information about the clause boundary. Hakes(1972) also showed that reducing complements increased sentence complexity.

Listeners not only have to make decisions about the underlying relations of word sequences but also have to make decisions about the relationships which hold between clauses. The needed information must be kept in working-memory to enable them to do this. Fodor, Bever, and Garrett(1974) have indicated, "Subjects may find difficulties both with structures which violate a perceptual strategy and those which place a heavy demand on short-term memory [p. 358] ." Thus, as memory systems affect comprehension, so, too, the comprehension system affects the amount and/or nature of information retained by the listener.

The process of semantic integration as described by Bransford and Franks(1971), Bransford, Barclay, and Franks(1972), and Bransford, Johnson, and Solomon(1973) apparently enables listeners to store more unified representations of meaning in memory. But studying sentences in isolation may provide different results from those obtained when studying sentences in relation to prior context. It is also important to consider those strategies utilized by listeners in their attempts to recall and/or comprehend information from stories. Researchers such as Perfetti and Goldman(1975) have begun to describe some of the processes involved in the memory for discourse, i.e., larger contexts including on-going conversations, paragraphs, and stories. They propose that

listeners actively search for themes, or main characters or ideas, in their efforts to organize the contents of a story. Some of the more specific processes involved in sentence and story memory will now be discussed.

Semantic Memory Revisited

Sentence Memory

Coleman(1965), Clark(1966), Horowitz and Prytulak(1969), James(1972), and James, Thompson, and Baldwin(1973) all studied the free recall of active and passive sentences in attempts to define those parts of sentences which are assessed by listeners as being important. Coleman(1965), Clark(1966), and Horowitz and Prytulak(1966) found that surface-structure subjects were recalled with greater frequency than surface-structure objects, suggesting a salience of first nouns. James(1972), however, argued that the above findings were confounded by syntactic position and image value. By image value, James(1972) meant that certain nouns, e.g.,"burglar"or "automobile," were more pictureable or imageable than other nouns, e.g.,"rumor"or"incident." By syntactic position, he meant that high imageable nouns tended to occur in the first position more frequently than less imageable nouns. Sentence (23) represents an example of a high-imagery and low-imagery noun in first and last positions respectively.

(23). The burglar was startled by the incident.

Controlling for image value and noun position, James(1972) found that the frequency and the accuracy for recalling either subject or object nouns was specifically related to their particular image value. Recall was not related to a noun's place or grammatical function in the sentence for both actives and passives.

Expanding upon James(1972), James, Thompson, and Baldwin(1973) emphasize the idea that highly imageable nouns become the themes of sentences. They argue that themes provide an important focus in memory. James(1972) writes, "It is likely that memory for sentences is organized around a theme, that theme being determined by nonsyntactic (i.e., situational) factors, such as context, saliency of context, and idiosyncratic interests[p. 210]."

James et. al. (1973) presented subjects with lists containing both active and passive sentences. Lists were read to the subjects followed by a 15 sec. interval and a three minute recall period. Subjects were instructed to write down as many of the original eight sentences as they could remember. Sentences were structured to control for both imagery and noun position. Sentences (24)/(24)' and (25)/(25)' contain one high imagery and one low imagery noun; sentences (26)/(26)' and (27)/(27)' contain two high imagery and two low imagery nouns respectively.

(24) The rumor was denied by the sultan.
(24)' The sultan denied the rumor.

(25) The incident startled the burglar.
(25)' The burglar was startled by the incident.

(26) The automobile was sold by the baron.
(26)' The baron sold the automobile.

(27) The incident started the rumors.
(27)' The rumors was started by the incident.

Replicating James(1972), James, Thompson, and Baldwin(1973) found that high imagery nouns were recalled more frequently than low imagery nouns regardless of their position or grammatical function in the sentence. They equated theme with the words recalled most often from the set of sentences. Thus, it was concluded that the theme in sentences (24)/(24)' was "sultan" and the theme in sentences (25)/(25)' was "burglar." When sentences contained nouns of equal imagery values, such as sentences (26)/(26)' and (27)/(27)', recall was generally equally distributed between the two nouns. There was a slight tendency, however, toward first-noun choices in the low imagery sentences (27)/(27)'. James, Thompson, and Baldwin(1973) showed that imagery and theme choice are related and that themes remain salient parts of sentences. They also demonstrated that listeners make their own decisions about what they think is important to remember in sentences when additional imagery cues were absent.

James, et. al.(1973) added a second part to their

experiment. They wanted to consider the possibility that the choice of a theme could be influenced in the high imagery sentences such as (28) below.

(28) The burglar startled the king.

Before hearing each sentence on the list, subjects were instructed to attend to one of the nouns in the sentence. They were told that this word was the theme of the sentence and that concentrating upon it would make the sentence easier to remember. Subjects were also told that if no word was given before the sentence that meant that the experimenter had no theme in mind for that sentence. As predicted by James et. al. (1973), the choice of themes was shifted to either subject or object preferences depending upon what had been given to the subjects immediately before. Theme choice was measured by the words most frequently recalled from the lists, by the number of sentences recalled correctly, and by analysis of the written paraphrases of subjects. For instance, objects such as "king" in sentence (28) were found to be used more frequently as surface subjects in the reconstructed versions of the listeners when objects had been given as the theme before. Thus, "The burglar startled the king," was transformed into, "The king was startled by the burglar" in the written recalled responses of the listeners.

A number of interesting findings were presented in

the above research. Themes remain salient in memory and form the focus around which sentences are organized. Imagery, rather than grammatical function, was the most important variable influencing theme choice. Theme choice can be influenced by what is given or what has come before. The role of surface-structure subjects, or first nouns, as themes needs further investigation.

Discourse Memory

Many researchers have provided evidence that listeners also use themes to organize information from stories. This type of investigation is important as one rarely processes sentences in isolation. Dooling and Lachman(1971), Bransford and Johnson(1973), and Sulin and Dooling(1974) all give examples of how titles and themes affect a person's ability to comprehend and remember details from a story. For example, Bransford and Johnson(1973) show that subjects were better able to recall and understand complicated stories if they were given titles or pictures representing a story's theme before presentation.

Pompi and Lachman(1967), Lachman and Dooling(1968), and Sulin and Dooling(1974) demonstrate that themes provide listeners with an essential idea around which they organize the other information in a story. They indicate that while people quickly forget individual sentences they tend to

retain those details and/or words which are most directly related to the theme. For instance, Sulin and Dooling(1974) presented subjects with passages about famous and ficticious people. After listening to the stories, subjects were given sentences and they were asked to indicate whether the sentences had appeared in any of the passages. The time interval between the passages and the recognition items was either five minutes or one week. These investigators found that passages which contained a famous main character such as Helen Keller produced more false recognition of sentences that were thematically related to the topic. Specifically, a sentence such as, "She was deaf, dumb, and blind," which had not been part of the story, was incorrectly identified by subjects as having appeared. The actual sentence was, "She was wild, stubborn, and violent." Sulin and Dooling(1974) conclude that responses of this type represent an intrusion of thematic ideas. By this they meant that listeners falsely recognize new sentences because they have integrated their prior knowledge of Helen Keller, for example, into the passage. Theme effects were greatest after the longer time interval.

Thorndyke(1975) also discussed some of the factors which affect people's ability to comprehend and remember stories. He provides evidence that listeners actively search for the inherent organization of stories. He also

showed that the amount of information recalled and understood was directly related to the amount of "identifiable organizational structure in the material (Thorndyke, 1975, p. 55)." For example, titled stories were easier for listeners to recall and comprehend than untitled stories. Likewise, stories containing unscrambled sentences were easier to comprehend than stories which contained scrambled sentences.

In one experiment, Thorndyke(1975) presented subjects with two types of stories: stories which were goal-directed such as (29) below and stories which were time-sequenced such as (30) below. By goal directed, he

(29) The farmer was trying to get his donkey into the shack. He walked out to the field. He knew that this would be a difficult task. First, the farmer opened the door to the shack. Then he went over to the animals' pen. He took some sugar with him. The farmer began pulling the donkey toward him without any success. Then he gave the donkey some sugar but the animal would not move.

(30) The farmer walked out to the field. He knew that this would be a difficult task. First, the farmer opened the door to the shack. Then he went over to the animals' pen. He took some sugar with him. The farmer began pulling the donkey toward him without any success. Then he gave the donkey some sugar but the animal would not move. The farmer was trying to get his donkey into the shack.

meant that the character's purpose was stated in the introductory sentence. By time-sequenced, he meant that the

sentences recounted the events of the story accurately but that the character's purpose, or his goal, was not explicitly stated until the end of the story.

Thorndyke(1975) found that subjects' recall and comprehension of details was better for the goal-directed stories. He considered their written paraphrases of the stories as well as their answers to questions. Thorndyke(1975) concluded that mentioning the plot or the goal at the beginning of the passage provided the listener with a unified theme or concept which clarified the other sentences in the story. He writes :

> "...prose comprehension consists not only of comprehension of individual sentences but of the integration of these sentences into a larger framework incorporating implicit causal, temporal, and motivational information. And...when an incoming sentence is predicted by or consistent with current context, the comprehension of the sentence should occur rapidly since it can be directly incorporated into the current context (Thorndyke, 1975, pp. 139, 140)."

Haviland and Clark(1974) provide evidence for sentence comprehension facilitation based upon contextual information in terms of what they called a Given-New Strategy. "Given" information refers to what the listener is expected to know and "new" information refers to what the listener is not expected to know (Haviland and Clark, 1974). Briefly,

Haviland and Clark(1974) found that preceding a target sentence with a sentence which explicitly stated some assumed or "given" information in the target sentence (as pairs (31) below) speeded comprehension time. Comprehension time was measured by subjects pressing a button to indicate that they understood the target (underlined below). The speed of comprehension for targets was slower when subjects were presented with "given" information which supplied more vague and/or contextual information (as pairs (32) below). The Given-New Strategy was supported whether

(31) We got some beer out of the trunk.
<u>The beer was warm</u>.

(32) George was especially fond of beer.
<u>The beer was warm</u>.

the critical noun was mentioned or not. The results, according the Haviland and Clark(1974), lend support to the idea that listeners attempt to relate what is heard to an antecedent already in memory (Haviland and Clark, 1974, p. 513).

Two detailed studies involving thematization, contextual information, and sentence memory are those of Perfetti and Goldman(1974) and Perfetti and Goldman(1975). Similar to James, Thompson, and Baldwin(1973), Perfetti and Goldman(1974) predicted that the theme of a sentence would be a better prompt for

retrieving that sentence from memory. In agreement with Lachman and Dooling(1968) and Thorndyke(1975), Perfetti and Goldman(1974) also proposed that many factors, including imagery, theme choice, and prior context, affect a listener's interpretation of information from a discourse or larger context.

Perfetti and Goldman(1974) studied subjects' ability to recall sentences. These investigators were specifically interested in the effectiveness of grammatical subject and object prompts with and without prior context. The sentences used were simple subject-verb-object constructions such as (33) below. A subject

(33) The serfs rebelled against the baron.

prompt would be "serfs" and and object prompt would be "baron." The prior contexts were thematized paragraphs. By thematization, Perfetti and Goldman(1974) meant, "The discourse processes by which a referent comes to be developed as the central subject of the discourse[p. 71]." Examples (34) and (35), respectively, represent abbreviated versions of the subject and object thematized paragraphs used by Perfetti and Goldman(1974). The underlined sentences represent the target sentences to be recalled. Serfs, the subject, is the thematized referent in paragraph (34); baron, the object of the sentence, is the thematized referent in paragraph (35).

(34) The documents were apparently written by an educated serf. Few details were known about the life of the serfs until now. The documents tell much about the daily life and culture of the serfs and the hardship they suffered under a harsh nobleman, Baron Wozjik. The documents describe the growing discontent of the serfs and became more revolutionary in tone until, dramatically : the serfs rebelled against the baron.

(35) The documents tell of the fate of Baron Wozjik. Baron Wozjik's influence suddenly declined in the mid-1600s. The documents reveal that the baron's power rested upon the wealth of his vast holdings in farmland. In 1651, he began to have difficulties with his labor force made up of serfs and drastically cutting back agricultural production : the serfs rebelled against the baron.

Perfetti and Goldman(1974) predicted that the better prompt would be the word reflecting a thematized referent regardless of whether it was a subject or an object. Perfetti and Goldman(1974) also predicted that prompt effectiveness would be equally distributed between subjects and objects when both nouns were high in imagery and when sentences were presented in isolation.

Subjects were given lists of twelve sentences each in tasks of free and prompted recall with no context in the first portion of Perfetti and Goldman's(1974) experiment. After the experimenter read the list, the subject was to write down as many of the original sentences as he could remember. In the prompted part,

the subject was given either the subject or the object of the sentence to help him retrieve the sentence from memory. Perfetti and Goldman(1974) found that when imagery was equal for both nouns in the sentence, subject and object noun prompt effectiveness were equal. This finding replicates James(1972) and James, Thompson, and Baldwin(1973). In free recall of sentences, however, there was a slight tendency for subject nouns to be recalled with greater frequency.

When sentences appeared at the end of thematized paragraphs, the results relating to prompt effectiveness shifted. The interaction between theme and syntactic role showed that the effect of thematization made objects (such as "baron") more efficient prompts when objects were the thematized referent. Subjects remained equally good as prompts regardless of whether they had been the thematized referent in the paragraph. For instance, "serf" was as good a prompt as "baron" in paragraph (35); however, "baron" was not nearly as effective as a prompt in paragraph (34). Perfetti and Goldman(1974) indicate that thematization of an object can establish a special focus on the object. But object thematization does not provide this focus "at the expense of the subject which remains as effective as when it had been thematized (Perfetti and Goldman, 1974, p. 78)."

The findings of Perfetti and Goldman(1974) provide the following information: The effectiveness of subject and object prompts for helping people recall sentences is different for isolated and context situations. "The apparent puzzle," write Perfetti and Goldman(1974), "is that while thematizing affected generally the retrieval power of the subjects, it did not matter which noun had been thematized [p. 78]." They conclude that thematization encourages listeners to employ a more general strategy for discourse which affects the final-context sentence. This strategy involves attending to the first noun or the theme of the paragraph. Thus, "to provide a thematic context is to give focus to the subject of the sentence (Perfetti and Goldman, 1974, p. 78)."

Perfetti and Goldman(1975) further explored the role of thematization in relation to the grammatical and underlying functions of nouns in sentences. They expanded upon Perfetti and Goldman(1974) by adding passive sentences to the end of thematized paragraphs. Example (36) represents a thematized passage used by Perfetti and Goldman(1975). Either an active or a passive sentence(underlined) would conclude the passage. Passage (36) shows the thematization of the underlying subject (the Admiral). Perfetti and Goldman(1975) also included passages which thematized the underlying objects.

(36) Within the State Department, the embassy in the Republic of Costa Rica has long been considered the most uneventful post in the foreign service. Rarely has anything occurred to disturb the diplomats' routine.

Until last night, Admiral Thomas J. Foster, the U.S. military attache, would have agreed with this description of diplomacy in Costa Rica. Admiral Foster, a veteran of two wars and a former commander of the Pacific Fleet, was assigned to the embassy there over two years ago. Working late in his office last night, Foster heard a strange noise down the hall. Upon investigating, he discovered the famous bandit, El Gato, trying to open the embassy safe. Target: The admiral captured the bandit. or : The bandit was captured by the admiral.

Subjects were given a number of passages to read for meaning and understanding. After fifteen minutes, they were asked to recall the final sentence of each passage. They were given either the first or second noun of the target sentence as a prompt. Perfetti and Goldman(1975) predicted that thematization would have an effect upon sentence recall regardless of the form of the final sentence, i.e., whether it was an active or passive. These investigators defined topicalization as the surface subject. They predicted the surface subject would have an effect upon sentence retrieval only as it interacted with thematization. Both verbatim and meaning preserving responses were analyzed.

Perfetti and Goldman found that instead underlying subjects were better prompts than underlying objects

regardless of thematization. However, underlying subject and object prompt effectiveness was enhanced by thematization. Underlying objects became particularly effective as prompts by the additive effects of both thematization and topicalization. Replicating Perfetti and Goldman(1974), however, it was found that underlying objects never exceeded underlying subjects in prompt effectiveness.

In a second experiment, Perfetti and Goldman(1975) used titled and untitled paragraphs in an attempt to shift the focus of memory to either a subject or an object. For example, "The Admiral" or "The Bandit" could become the title of paragraph (36). In this experiment, subjects were asked to choose between an active and a passive sentence to complete paragraphs. It was found that active sentences were chosen more frequently than passive sentences regardless of the story titles. There was a greater preference for passives only when the underlying recipient had been thematized and when it was also the title of the passage. Perfetti and Goldman(1975) concluded: "Thematization provides a stable referential focus for new information while...topicalization...provides momentary focus for information currently presented [p. 271]." Indeed, Perfetti and Goldman(1975) argue: "Thematization is a mechanism for influencing the coding of a narrative event prior to a sentence which concludes the narrative [p. 259]."

Much information is currently available relating to sentence and story memory and comprehension. Thus far, the discussion has provided an overview of some of these processes in adults. It is true that young language users come to the task of sentence and discourse processing with comprehension and memory systems which are far from complete. Since it is important to know more about the interaction of these systems, the developmental and disordered aspects of language comprehension will now be discussed.

Sentence Processing and Development

There is a quickly expanding literature in child language acquisition in the 1970's of developmental psycholinguistics emphasizing the study of comprehension strategies. Numerous examples of the almost systematic progression of comprehension development through its different aspects and stages can be found in today's studies.

Canonical-Sentoid Strategies

Bever(1970) offers a central focus point for much of the strategy acquisition literature. He emphasizes the importance of canonical-order strategies

by observing children's manipulations of objects to act out sentences. Bever(1970) indicates that children, as young as two, interpret any noun immediately preceding the main verb of a sentence as the logical subject of the sentence. At about three-and-a-half-years-old, children interpret the first noun of the sentence as the actor, independent of its surface relation to the verb (Fodor, Bever, and Garrett, 1974, p. 499). Canonical-order strategies, then, not as developed as those of adults, begin as First Noun/ Actor strategies. However, children are apparently able to distinguish between sentences they understand from sentences they cannot understand even at these early ages(two and three-years-old). Bever(1970) reports that First Noun strategies are not indiscriminantly applied to all sentences. While two and three-year-olds perform almost ninety-five per cent correct on simple reversible actives (e.g., (37) below), they perform almost randomly on reversible passives (e.g., (38) below) (Bever, 1970, p. 304). By reversibility,

(37) The cow kisses the horse.

(38) The tiger is chased by the alligator.

Bever(1970) meant that either noun in the sentence could be the logical subject or object of that sentence.

Bever(1970) also reports that two-year-old children have difficulty with two clause sentences such as (39) and (40) below. He indicates a second strategy whereby children begin by picking the first noun-verb sequence (cow jumped) as important -- acting out the first or the subordinate verb. More

(39) The cow that jumped walked walked away.

(40) The cow jumped and walked away.

advanced children learn to discriminate main and subordinate verbs and to consider the main verb (walked) as most important.

At about four-years-old, children become more aware of semantic constraints. By semantic constraints, Bever(1970) meant that children become more sensitive to certain logical-functional relationships which hold between the constituents of a sentence. For example, in (41) below, a nonreversible passive,

(41) The flowers are watered by the girl.

"girls" can water "flowers" but "flowers" cannot water "girls." At this point in development, performance on nonreversible passives improves(Slobin, 1966).

Bever(1970) indicates that shortly after this development, i.e., sensitivity to semantic constraints, children begin to rely upon a more refined canonical-order strategy for comprehending sentences. This strategy involves segmenting the first noun-verb-noun sequence in the sentence to correspond to the actor-action-recipient of that sequence. While semantic constraints may, in a sense, protect the child from misinterpreting nonreversible passives such as "The flowers are watered by the girl" (FLOWERS WATER GIRL), the application of the N-V-N/actor-action-recipient strategy results in poorer performances on reversible passives such as "The tiger is chased by the alligator" (TIGER CHASES ALLIGATOR). Bever(1970) points out that the results on both active and passive sentences (reversible and nonreversible types) strongely suggest that all children pass through periods of overapplying the N-V-N strategy and misinterpreting those sentences in which the first noun is the object rather than the actor (Bever, 1970, p. 311).

Using a different technique, speed of comprehension, Forster and Olbrei(1973) present conflicting data on reversibility. They found that passives took longer to process than actives regardless of reversibility. They argue that semantic variables do not affect the immediate

syntactic processing of a sentence although they may influence the speed at which sentences are ultimately interpreted.

Cromer(1971) observed children's manipulations of duck and wolf puppets to sentences such as (42) and (43) below. His subjects ranged in age between five and seven-years-old. They were told to show the

(42) The wolf is eager to bite.

(43) The wolf is easy to bite.

experimenter whether it was the wolf or the duck who was doing the biting. Cromer(1971) indicated that children look for the subject of the infinitive (to bite). Their responses were correct when the first noun ("wolf" in (42)) was the subject-actor. More errors were made when the first noun was the object-recipient of the infinitive ("wolf" as in (43)). Cromer(1971) provides additional evidence for the operation of the first-noun/actor strategy. His subjects did not consistently, and correctly, respond to types (43) (making the duck bite the wolf) until after six-and-a-half-years old. Chomsky(1969) found a similar pattern with her young children's responses to eager/easy sentences.

Slobin(1971), observing the early acquisition of comprehension across many languages, found that children tend to use canonical-order strategies in their attempts to understand sentences. He indicated, "Pay Attention to the Order of Words and Morphemes" as an early, and universal, operating principle (Slobin, 1971, p. 348).

Clausal Strategies

The development of clausal strategies, semantic knowledge, and more sophisticated strategies offers an increasingly interesting domain for research and discussion. The canonical-order strategy, however, remains an important and persistent one. In some cases, the canonical-order strategy overlaps with newer strategies both during and after their development.

Clark and Clark(1968) point out that when the order of mention of clauses corresponds to the order of events ((44) below), comprehension and memory of double clause sentences can be facilitated even in children below the age of five.

(44) Move the blue plane before you move the red plane.

Amidon and Carey(1972), however, found that their five-year-old subjects attended to the main clause (during object manipulation instructions) regardless of the clause order within sentences. Kindergarteners appeared to have more difficulty processing sentences with subordinate clauses ("Move the blue plane before you move the red plane.") even though they had no problems with coordinate commands containing two clauses ("Move the blue plane first; Move the red plane last.").

Amidon and Carey(1972) conclude that errors on subordinate-main and main-subordinate sentences cannot be assigned to short-term memory difficulties alone. They believe that the errors made by their subjects involve a lack of understanding regarding subordinating syntax and the emergence of a new strategy. Amidon and Carey(1972) point out that while order-of-mention may be more of an all-encompassing strategy for interpretation of temporal clauses at age four, it apparently becomes somewhat less important by age five. In general, subordinate-main constructions remain harder to process. Thus, at about five-years-old, children are learning the differences between clauses and the relations which hold between them. As put by Amidon and Carey(1972): "With development, strategies emerge and become dominant over older ones, which are subordinated but not replaced [p. 423]."

Relativization and Parallel Function Strategies

The subject of relative clause sentences enables the researcher to take the discussion of strategy development even further. It is possible to consider word order and subordination effects as well as to consider the semantic relations involved in relativization and its interaction with short-term memory. Miller(1962), for example, has proposed that interruption of the main clause, or clause embedding, increases processing difficulty. He writes that "Self-embedding...places heavier demands on the temporary storage capacity (Miller, 1962, p. 755)." Miller and Isard(1964), Blumenthal(1966), and Blaubergs and Braine(1974), studying adults, provide evidence in support of this notion. Hakes, Evans, and Brannon(1976), on the other hand, find no evidence in support of this Interruption Hypothesis. They point out that the results mentioned above are based on errors in recall and paraphrase accuracy with multiple self-embeddings such as (45) below. Hakes, et. al. (1976) indicate that multiple self-embeddings place unreasonable demands upon memory which are not accurate representations of a listener's capacity to handle interruptions between clauses.

(45) The lion the dog the monkey chased bit died.

Slobin(1971), studying children, supports the

Interruption Hypothesis. He indicates that interruption of linguistic units makes sentence processing more difficult. For example, Slobin(1971) found that relative clauses which modify subjects (subject relatives) such as (46) below were more difficult for young children to comprehend than relative clauses which modify objects (object relatives) such as (47) below. Slobin accounted for these results by noting

(46) The man that fell down ran away.

(47) I saw the man that fell down.

that subject relatives break up the subject/verb of the main sentence and hence put a greater strain on short-term-memory than do object relatives.

Sheldon(1974) reports that different variables -- other than interruption of the main clause -- affect children's comprehension of relative clause sentences. Recall (page 31) that subject-focus relatives, which do not violate canonical order, have been found to be easier to process than object-focus relatives.

Sheldon discusses the Parallel Function Hypothesis. To test this hypothesis, she considered the underlying role of the relativized noun as a subject or object within main and subordinate clauses. A noun has a parallel function if it is the subject or the object in both clauses. For example, the relativized noun, "giraffe," in sentence (48) below is the subject/actor of both main and relative

clauses. Sentence (48) represents a subject relative with a subject focus. Focus refers to the underlying function of the relativized noun within the relative clause (See also page 31 of this paper.). This type is abbreviated SS. On the other hand, the relativized noun, "zebra," in sentence (49) below is the object/ recipient of both main and relative clauses. Sentence (49) represents an object relative with an object focus. This type is abbreviated OO.

(48) The giraffe that bites the wolf kicks the hippo. (SS)

(49) The hippo bites the zebra that the bear jumps over. (OO)

A noun has a split (or nonparallel) function if it is the subject of one clause and the object of the other clause. For example, the relativized noun, "wolf," in sentence (50) below is the subject of the main clause and the object of the relative clause. Sentence (50) represents a subject relative with an object focus. This type is abbreviated So. The relativized noun, "tiger," in sentence (51) is the object of the main clause and the subject of the relative clause. Sentence (51) represents an object relative with a subject focus. This type is abbreviated Os.

(50) The wolf that the hippo stands on kisses the zebra. (So)

(51) The alligator chases the tiger that bites the lion. (Os)

Sheldon(1974) observed children's manipulations of objects to these four types of relative clause sentences -- SS, OO, So, and Os. The subjects she studied were between three and five-years-old. The children were told that they were going to play a game in which they were a zookeeper. They had to make the animals do what the experimenter said. The experimenter sat with each child and recorded the toy moving responses. A series of coordinate sentences, i.e., two-clause sentences joined by "and", were included to rule out short-term memory as the only processing variable. The coordinate sentences represented counterparts to the relative clause sentences. Sentence (52) below provides an example of an SS- coordinate. Here the "giraffe" (as in sentence (48)) is the subject/actor in both clauses.

(52) The giraffe kicks the hippo and the giraffe bites the wolf.

Sheldon(1974) found that the coordinate sentences

were sifnificantly easier for children to process than the relative clause sentences. She indicated that this result provides additional information about children's comprehension. Her subjects were able to act out (and recall) two propositions. Sentence length was not a confounding factor. Likewise, the children understood the nature of the task.

The variables defined over the sentences provided the different degrees of processing difficulty. Sheldon found that performances on the parallel function sentences, SS and OO relatives, were significantly better than performances on the nonparallel sentences, So and Os relatives, at all age levels. Neither self embedding (interruption of the main clause) nor violations of canonical order within relative clauses were found to be significant variables. SS sentences showed the greatest improvement with age. The five-year-olds performed better than the three-year-olds on this particular type. Performances on OO sentences remained about the same across ages.

Sheldon(1974) considered errors as well as correct responses to explain her findings. She also hoped to gain additional insight into the strategies that children use. She indicates that what is hard about learning to process relative clause sentences is: a) finding the grammatical function of the relativized pronoun; b) finding the noun the relative clause modifies (Sheldon, 1974, p. 280).

According to Sheldon(1974), children employ two strategies in their attempts to comprehend relative clause sentences:

1. The Parallel Function Strategy - Assume that the relativized pronoun has the same grammatical function as its antecedent.
2. The Extraposition Strategy - Make the relative clause modify the first noun.

Use of either of these strategies helps to explain the generally stronger performances on the SS sentences (such as (53) below). For this type, the relativized noun already has the same function (subject) as its antecedent.

(53) The giraffe that bites the wolf kicks the hippo.

Also, the relative clause modifies the first noun. Thus, SS relatives provide a strategy-structure match. Application of the extraposition strategy on OO relatives (such as (54)), on the other hand, proves to be inappropriate.

(54) The hippo bites the zebra that the bear jumps over.

(54)' (With Extraposition)
The hippo bites the zebra/bear jumps over the hippo.

Performances on the So and Os relatives were the poorest across all ages. Both sentence types contain nonparallel relationships. So sentences, such as (55) below, were the most difficult. Indeed, So sentences are interrupted and they manifest violations in canonical order -- in conjunction with nonparallel functions of the relativized

noun. Many errors on So sentences involved assuming that the "wolf" was the actor in both clauses -- application of the Parallel Function Strategy.

(55) The wolf that the hippo stands on kisses the zebra.

Errors on Os sentences, such as (56)' below, involved a mixture of parallel function and extraposition strategies.

(56) The alligator chases the tiger that bites the lion.
(56)'The alligator that bites the lion chases the tiger.

Sheldon(1974) indicates that the two strategies are important. She points out that parallel function and extraposition often overlap. Indeed, her subjects are apparently searching for the underlying function of the relativized noun and the noun which the clause modifies. Sheldon(1974) concludes, however, that parallel function provides the overriding effect based upon the better performances on SS and OO sentences. She goes on to say that the importance of parallel function should be investigated with constructions other than relative clause sentences.

There may be some support for parallel function in Chomsky's(1969) data on pronominalization. Chomsky(1969) points out that children, below the age of five-and-a-half, assume that the subordinate clause pronoun always refers to the subject noun of the main clause. For example,

in sentence (57) below, "he" can refer to someone else. Children, however, consistently begin by interpreting the pronoun as referring to "John."

(57) John knew that he would win the race.

This preference can be viewed as indicative of a parallel function strategy. It suggests that Sheldon's findings may not be isolated ones. As put by Sheldon(1974), the role of parallel function may provide a fruitful avenue for future research. She suggests that researchers should reconsider "false predictions about the role of interruptions as well as the role of correspondence between surface and deep structure word order (sheldon, 1974, p. 280)."

Brown(1971) also studied children's comprehension of relative clause sentences. He observed the performances of three, four, and five-year-olds in a sentence-to-picture matching task. Brown(1971) found that subject focus relatives, SS and Os sentences, were significantly easier than object focus relatives, OO and So sentences. He also found that the four and five-year-olds performed better than the three-year-olds. For subject focus types, SS were easier than Os sentences. For object focus types, OO were easier than So sentences.

Both Brown(1971) and Sheldon(1974) agree that relative clause sentences are difficult for young children

to process. Both researchers found SS relatives to be the easiest type. Both found So relatives to be the most difficult. However, Sheldon(1974) indicated that the parallel sentences, both SS and OO, were significantly easier than the nonparallel sentences, Os and So. Brown(1971), on the other hand, found focus to be the overriding variable. He reported that the subject focus sentences, both SS and Os, were significantly easier than the object focus sentences, OO and So. Canonical order within clauses was a significant variable affecting comprehension in Brown's(1971) data; it was not a significant variable in Sheldon's(1974) data. The main difference between the two researchers lies in their results with the object relatives -- the OO and Os sentences.

It should be pointed out, however, that Brown(1971) and Sheldon(1974) used different materials. They also required different responses from their three to five-year-old subjects. Sheldon(1974) used all animate nouns (animals). She required subjects to manipulate toys. Brown(1971) used animal and inanimate nouns. He required subjects to pick the correct picture to represent the sentence from a choice of two pictures. Clearly, then, the variables of parallel function, relative clause focus, and canonical order within clauses need further investigation.

Certainly, it is important to consider the processing of sentences in relation to the strategies which are available to children during acquisition. It is also important to consider the comprehension of sentences in relation to extralinguistic factors, such as contextual cues, and a listener's knowledge of the world.

Extralinguistic Factors and Child Language

Sentence To Situation. Huttenlocker and Strauss(1968), Huttenlocker, Eisenberg, and Strauss(1968), and Huttenlocker and Weiner(1971) studied children's interpretation of statements in relation to the extralinguistic situation they described. By extralinguistic situation they meant what the child was observing visually in relation to the sentence he was hearing. For example, Huttenlocker and Strauss(1968) presented children with a ladder type structure. The children were asked to manipulate an object (a mobile block) in relation to one which was already in a fixed position on the ladder (a fixed block). Commands such as (62) and (63) were given to the children.

(62) Make it so that the red block (mobile) is on top of the orange block (fixed).

(63) Make it so that the orange block (fixed) is on top of the red block (mobile)

It was found that sentences were significantly easier when the mobile block was described as the subject as in sentence (62) (The red block is on top of the orange block.). Huttenlocker and Strauss(1968) point out that children search for the underlying subject of the situation. They apparently view the mobile block, or the block in their hand, as the doer/actor. The mobile block has a double function -- it is the moveable/doer of the action and it provides a more stable focus around which the other activities follow. Huttenlocker and Strauss(1968) also suggest that children recode sentences such as (63) in which the fixed block is the first noun. Thus, "Make it so that the orange block(fixed) is on top of the red block" becomes "The red block is under the orange block." Children try to make the activity and the sentence parallel. The red block is in their hand and, thus, the red block is made the first noun or the subject of the sentence. As put by Huttenlocker and Strauss(1968), "S's comprehension problem is to bring E's statement into coordination with events which require a particular form of description [p. 304]."

Semantic Integration. Brown(1976) studied semantic integration in children. She reports that children, as young as four, were able to distinguish semantically-inconsistent pictures when they were asked to re-sequence

pictures to form a story they had previously been given. However, even young children tended to integrate semantically-consistent but newly-given pictures into the story. Brown(1976) indicates that "Memory for logical narrative sequences involves the retention of the gist or theme into an integrated unified representation of meaning rather than a series of discrete events [p. 247]."

Paris and Lindauer(1976) attempted to look further into the developmental changes in inferrential processing and its relation to memory. They studied children between six and twelve-years-old. Sentences with both explicitly stated instruments such as (64) below and sentences with omitted instruments such as (65) below were used.

(64) The workman dug a hole in the ground <u>with a shovel</u>.

(65) The teacher cut the steak.

Paris and Lindauer(1976) hypothesized that if children spontaneously generated the implied and appropriate instruments, then using "knife" as a prompt for sentence (65) would prove to be as effective as using "shovel" as a prompt for sentence (64).

These researchers presented children with lists containing four explicit and four implicit sentences. Explicit sentences actually contained the correct in-

strument (type (64)). Implicit sentences did not contain mention of the correct instrument (type (65)). Subjects were told to listen carefully and try to remember as many of the sentences as they could. Four minutes after presentation, the experimenters prompted the children with the instruments of each sentence. The investigators asked each child to tell which sentence from the list came to mind.

Paris and Lindauer(1976) found that both cue type (explicit-implicit) and grade level (first, third, fifth) had an effect. First and third-graders (six to eight-year-olds) recalled more sentences with explicit instrument prompts. Fifth graders recalled the implicit and explicit sentences equally well. Thus, it was concluded that the older subjects (the eleven and twelve-year-olds) apparently generated the implicit information during processing. These subjects also incorporated this information into memory representations for use in accessing the entire sentence's meaning (Paris and Lindauer, 1976, p. 221).

Paris and Lindauer(1976) added another part to their experiment. They instructed first graders (six and seven-year-olds) to act out the sentences with gestures. Paris and Lindauer(1976) told the children that doing this would make the sentences easier to remember. The researchers believe that acting out sentences forces the child to process

the implied instrument. Gesture also provides a readily observable response. Paris and Lindauer(1976) indicated that the results were simple and dramatic: The young children now recalled implicitly cued and explicitly cued sentences equally well (with a proficiency on the average of about seventy-one per cent).

The findings reported by Paris and Lindauer(1976) bring to mind the studies of Bransford et. al. (1972). They also indicate an idea for initiating processing. Indeed, if it is possible to improve performances on sentences by requiring children to gesture, there may be ways of developing new remediational procedures for language and learning disabled children. As summarized by Paris and Lindauer(1976) :

> "Future research on children's inferential processes of memory should investigate developmental changes in comprehension of a range of semantic inferences, the role of metamemorial plans in age by strategy interactions and 'ecologically valid' tasks which permit ready extrapolation to children's everyday tasks and processing demands[p. 226] ."

Sentence Processing and Learning Disabilities

Researchers and educators have a long way to go before completely understanding the problems of learning disabled children. Nevertheless, many professionals are now re-evaluating concepts which propose that

auditory perceptual failures underlie language or learning failures or that "adequate auditory discrimination is essential for the acquisition of language and for learning to read (Witkin, 1971, p. 42)."

Wiig and Semel(1973), Wiig, Semel, and Crouse(1973), Goldsmith, Wallach, and Beilin(1974), Semel and Wiig(1975), and Weiner-Mayster(1975), among others, have provided information regarding the language difficulties of learning disabled children.

Semel and Wiig(1975) report that learning disabled children do not perform as well as normally achieving children on standardized language tests. They considered performances on the Northwestern Screening Syntax Test (NSST) and the Assessment of Children's Language Comprehension Test (ACLC). The NSST receptive subtest consists of twenty paired sentences (such as (66) and (67) below). The child is required to pick the correct picture from a choice of four to go with the spoken sentence. The ACLC consists of forty items. It uses a core vocabulary and the items increase in complexity from single elements (i.e., "Point to bat") to phrases containing four elements. The child is required to point to the best picture from a choice of four. Examples (68) and (69) represent two and four element items respectively.

(66) The boy sees the cat.
The boy sees the cats.

(67) The boy is pushed by the girl.
The girl is pushed by the boy.

(68) horse standing

(69) happy little girl jumping

Semel and Wiig(1975) tested children between seven and eleven-years-old. They found that the learning disabled children scored significantly lower than their matched controls on both tests. Additionally, younger learning disabled children (seven to nine) and older learning disabled children (nine to eleven) did not differ significantly in their performances. Semel and Wiig(1975) indicate this suggests that deficits in comprehension may not spontaneously improve with age (Semel and Wiig, 1975, p. 53). The LD children performed similarly to the normal six-and-a-half-year-olds on the ACLC test. The normal children achieved a ceiling effect on the ACLC. LD children performed poorly with items containing four elements. However, errors occurred less frequently on the first and last elements than on elements in the intermediate positions. Semel and Wiig(1975) propose that these findings are generally consistent with the idea of an interaction between grammatical complexity and memory deficits.

Items on the NSST which were especially difficult for the learning disabled children included: sentences

with wh forms (such as (70) below), sentences with possessive relations (such as (71) below), and sentences with direct/indirect object relations (such as (72) below).

(70) Look who is here.
Look what is here.

(71) This is a mother's cat.
This is a mother cat.

(72) The man brings the boy the girl.
The man brings the girl the boy.

Wiig and Semel(1973) studied the responses of learning disabled children on other types of sentences. They considered sentences containing familial relations ((73) below), spatial relations ((74) below), sequential relations ((75) below), and comparative relations ((76) below). They also included responses on passive sentences ((77) below). Wiig and Semel's(1973) subjects were learning disabled and normally achieving children

(73) Give another name for your mother's father.

(74) The elephant sat on the cat. Who was on the bottom?

(75) Does Spring come before Winter?

(76) Are watermelons bigger than apples?

(77) Mary was pushed by Jane. Who is doing the pushing?

between the ages of seven and eleven-years-old.

Wiig and Semel(1973) found both quantitative and qualitative differences between the learning disabled and the normally achieving children. The LD children made significantly more errors than the normal children ($\overline{X}$ = 16.6 vs. 5.8). Also, the hierarchy of difficulty was somewhat different for the two groups. The familial, spatial, and sequential sentences were the most difficult for the learning disabled children. The sequential, spatial, and passive sentences were the most difficult for the normal children. Comparatives were the easiest for both groups.

A number of overlapping variables may be accounting for the above results. For example, in order to respond correctly to the familial sentences a child must have the available vocabulary. He must also have some control over the morphological rules for possessive. Likewise, to respondCorrectly to the sequential sentences, the child must know the seasons and understand the meaning of before and after. The spatial and passive sentences involve a statement followed by a wh-question.

Indeed, inadequate comprehension strategies, long- and short-term memory difficulties, and/or conceptual limitations (i.e., lack of understanding of temporal events or spatial relations) may all be contributing to the problems of the learning disabled child. Oddly, little information is currently available regarding sentence memory and semantic integration in learning

disabled children. Likewise, information is meagre relating to the qualitative strategy differences manifested by learning disabled children. More recently, however, Weiner-Mayster(1975) and Klein(1977) report that semantic integration is not as strong in LD children.

Wallach and Goldsmith(1975) studied older learning disabled and normal children between nine and twelve-years-old. They hoped to consider the problems of comprehending complex syntax. They also wanted to observe the different comprehension strategies which are employed by learning disabled children. Wallach and Goldsmith(1975) used subject relatives with subject focus, the SS relatives such as (78) below, and subject relatives with object focus, the So relatives such as (79) below. The SS relatives

(78) The giraffe that jumps over the lion hits the elephant. (SS)

(79) The giraffe that the lion jumps over hits the elephant. (So)

manifest parallel function. "Giraffe" is the subject-doer in both clauses. The So relatives manifest nonparallel function. "Giraffe" is the subject-doer in the main clause; it is the object-recipient in the relative clause. The children were asked to manipulate toy objects to act out the sentences.

Briefly, Wallach and Goldsmith(1975) support the

general findings in the literature. They found that the SS relatives were much easier for all the children to process than the So relatives. The LD group, however, made more errors overall. The normal group, particularly the eleven and twelve-year-olds, were obtaining perfect or near-perfect scores. Two strategies were common to both learning disabled and normal children :

1. Parallel Function Strategy - Assume the First Noun is the actor of all actions (used on So sentences).

2. Canonical-order (recency) Strategy - Assume that the last N-V-N corresponds to the actor-action-recipient of that sequence (used on SS mainly).

Stick and Norris(1975) studied recall and comprehension of relative clause sentences. Their subjects were learning disabled and normally achieving children between seven and twelve-years-old(Grades 1 - 6). The sentences used were double and single embedded relatives with subject and object focus. Semantic constraints were also considered. Sentences (80) and (81) below represent examples of doubly embedded relative clause sentences with and without semantic constraints respectively. Children were asked to manipulate toy

(80) The cat that the dog that the child petted ate the mouse.

(81) The pig that the cow that the horse chased scared ate the corn.

objects to act out the sentences. They were also asked to repeat the sentences.

Stick and Norris(1975) report that the normal children were making significantly fewer errors in both recall and comprehension by Grade 3. Normally achieving nine-year-ols did not differ significantly from normally achieving twelve-year-olds. The LD children were performing similarly to the normal seven and eight-year-olds. They did not improve after Grade 3 level. LD children who were eleven and twelve-years-old were still manifesting many difficulties in recall and comprehension of relative clause sentences.

The most difficult sentence type across all ages and groups were the doubly embedded sentences without semantic constraints (such as (81)). Object focus sentences were more difficult than subject focus sentences. A greater number of errors were made by all children on the comprehension task (manipulation of objects) than were made on the recall task (repetition of sentences). Stick and Norris(1975) suggest that further investigations involving the qualitative differences manifested in the language performances of learning disabled children are needed.

Summary of the Above Findings. Many researchers are currently emphasizing the importance of studying the comprehension strategies employed by learning disabled

children. Paris and Lindauer(1976), among others, have indicated that integrational-memory abilities should be studied in conjunction with available comprehension strategies. Stein and Prindaville(1976) and Kagan et. al. (1973) have proposed that researchers should consider the different cognitive styles manifested by these special children. By cognitive style, they meant the way children approach a task. This includes the types of errors children make. Perfetti and Goldman(1976) suggest studying the organizational factors in both discourse and short-term memory.

The Present Research. The main goal of this study is to relate children's ability to formulate comprehension strategies to their memory-integrational abilities. The qualitative strategy differences that exist between normally achieving and learning disabled children and that manifest themselves within the LD population will be explored. This research will provide additional insight into the nature of the problems of the older learning disabled child. It will also contribute information regarding the interaction between comprehension and memory systems. The processing of four types of relative clause sentences with and without contextual cues was chosen as the central focus for this study. Since the construction of themes is considered to be one of the

important aspects of processing connected discourse, the effects of thematized contexts were used in an attempt to relate this type of memory organization to sentence processes (Perfetti and Goldman, 1975).

Chapter 3

Research Design

The present study consisted of the following three experiments. Experiment 1 compared the comprehension of learning disabled and normal children on four types of relative clause sentences. Experiment 1 demonstrated that many learning disabled children employ different comprehension strategies from those employed by normals. Experiment 1 divided the learning disabled children into two main strategy subgroups based upon the nature of their errors. The dependent measure was a child's manipulation of objects to demonstrate comprehension. Nine animal objects represented the various actors and recipients within the sentences.

Experiment 2 compared the comprehension of the same types of relative clause sentences after thematized and non-thematized paragraphs among the three different categories of children isolated in Experiment 1. One between-group variable, GROUP (LD-Strategy Users vs. LD-Inconsistent vs. Normal), and two within-subjects variables, PRIOR CONTEXT (Thematized vs. Non-Thematized) and SENTENCE TYPE (SS vs. So vs. OO vs. Os), were investigated. The dependent measure was a child's

manipulation of toy figures to demonstrate comprehension. Twenty-four doll objects represented the various actors and recipients within the sentences. Data were analyzed both quantitatively and qualitatively.

Experiment 3 attempted to provide some supplementary information regarding the use of clustering as a strategy for free recall facilitation among the three categories of children. The dependent measure was the number of words recalled from clusterable and non-clusterable word lists.

Subjects

Fifty learning disabled and twenty normally achieving children between the ages of 8:6 and 13:9 served as the subjects for this investigation. Age, IQ (all above 90), and socioeconomic levels (middle class) were held constant.

The learning disabled children all attend a private school specifically designed for children with learning problems. "Though manifesting a variety of problems, their primary difficulties do not appear to be due to mental retardation or emotional disturbance (Rourke, 1975, pp. 911-912)." The LD children in this study have been defined behaviorally. Psychological, neurological, and educational records are available.

The normal children all attend a private school in Flushing, New York (in the same neighborhood as the LD school). They have been described by their principal as "average, normally achieving children."

The only formal testing done by the experimenter before beginning the study included a simple audiometric screening at 20db. for the frequencies 500, 1000, 2000, and 4000 Hz. to rule out the possibility of hearing impairments.

Sentences

A series of twenty complex sentences, twelve relative clause and eight coordinate sentences, were used in Experiment 1. Based mainly upon the work of Sheldon(1974), subject and object focus relatives manifesting parallel and non-parallel functions were designed. Sentences (82) and (83) below represent examples of subject relatives with respective subject and object focus. Sentence (82) is a parallel function relative. Sentence (83) is a non-parallel function

(82) The giraffe that bites the wolf kicks the hippo.(SS)

(83) The wolf that the hippo stands on kisses the zebra.(So)

relative. Sentences (84) and (85) below represent object

relatives with respective object and subject focus. Sentence (84) is a parallel function relative. Sentence (85) is a non-parallel function relative.

(84) The hippo bites the zebra that the bear jumps over.(OO)

(85) The zebra hits the hippo that stands on the bear.(Os)

Eight coordinate (conjoined) sentences served as filler-controls. Sentences (86) - (89) below represent coordinate counterparts for SS, So, OO, and Os relatives respectively.

(86) The giraffe kicks the hippo and the giraffe bites the wolf. (SS)

(87) The wolf kisses the zebra and the hippo stands on the wolf. (So)

(88) The hippo bites the zebra and the bear jumps over the zebra. (OO)

(89) The zebra hits the hippo and the hippo stands on the bear. (Os)

A complete list of the sentences appears in Appendix A.

Context Paragraphs

Eight paragraphs with eight final sentences for comprehension (representative of the four types employed in Experiment 1) were used. Based mainly upon the work of Perfetti and Goldman(1975), thematized and non-thematized paragraphs preceded the final sentences. Each story- had an introductory sentence, three main sentences, and a lead-in sentence to the final sentence.

A thematized story contains a main character -- a central subject or referent. The main character is the subject of the three main sentences in the paragraph. The events in the story happen in relation to/or through the eyes of this character. A non-thematized story does not have a main character.

Each child received four target-final sentences after each of four thematized stories and four final sentences after each of four non-thematized stories. Paragraphs were counterbalanced across the thematization condition. Thus, no subject received the same final sentence twice. Each type of relative clause sentence (SS, So, OO, Os), however, appeared twice -- once after a thematized story and once after a non-thematized story. Table 1 provides counterbalanced examples of one thematized and one non-thematized story used in Experiment 2.

It was decided by the researcher that the thematized referent in each thematized paragraph would be the non-relativized noun phrase within the relative clause. The result is that two stories contain subjects which have been thematized and two stories contain objects which have been thematized. Sentences (90) - (93) represent the four types of relative clause sentences and their thematized referents (underlined) :

(90) SS (Object theme)	The indians that captured the Chief killed the medicine man.
(91) So (Subject theme)	The nurse that the doctor pushed bumped into the tennis player.
(92) OO (Subject theme)	The Lieutenant found the engineer that the Captain screamed for.
(93) Os (Object theme)	The King touched the Prince that killed the Queen.

Appendices B and C contain a complete copy of the counterbalanced stories and final sentences.

Word Lists

Two lists of nine words each -- one list which lends itself to category organization and one list which does not -- were used in Experiment 3. Both clusterable and nonclusterable lists were balanced in terms of frequency of occurrence and familiarity. These lists were suggested and taken from Vaugh(1968)

Clusterable lists A and B contained three categories--parts of the body, animals, and transportation--with three items in each category. The control nonclusterable lists, lists A' and B', contained nine words which were not related by category. Appendix D contains a complete copy of the word lists used in Experiment 3.

TABLE 1

EXAMPLES OF COUNTERBALANCED THEMATIZED AND NON-THEMATIZED PARAGRAPH AND FINAL RELATIVE CLAUSE SENTENCE USED IN EXPERIMENT 2

The Olympic Games
(Thematized)

The whole United States team was very excited about going to the Olympics in Innsbruck, Austria. On the plane, Coach John Benson talked to Cindy, the pretty skier about the Olympics saying: "Just do the best you can. You're part of a great team." Then the coach listened as Bill Harris, the ice skater talked about winning a gold medal. But with all this fun, Coach Benson was still a little sad and a little jealous. And as it turned out -- after the games in Austria (* Signal : Target (So) - The skier that the coach kissed went away with the ice skater.)

The Baseball Game
(Non-thematized)

All the people at Community Hospital were very happy about their big charity baseball game. In the morning, Dr. James Todd gave out the equipment and told everyone: "This game will help us get money for our great hospital!" Then, Nurse Judi Bart laughed as everyone came onto the field and started having a good time. The famous tennis player, John Newton was also smiling because playing in the hospital game was such a good cause. And running the bases -- with everyone fooling around (*Signal : Target (So) - The nurse that the doctor pushed bumped into the tennis player.)

The Auditory Sequential Memory subtest of the Illinois Test of Psycholinguistic Abilities (ITPA) was also administered to each child.

Procedures

1. Manipulation of Objects

In both Experiment 1 and Experiment 2, the children were asked to manipulate toy objects to demonstrate comprehension. Neither superficial retention of sentence structure nor rote memorization of information were of interest here. Due to the problems sometimes encountered in sentence-to-picture matching, such as clearly representing the actors and recipients, giving fair picture choices, and due to the importance of defining spontaneous comprehension strategies, object manipulation was considered to be the better way to measure and analyze responses.

2. Cuing

The stimulus sentence appears as the final sentence of a story in Experiment 2. Thus, a bell was presented immediately before the final sentence so that the subject would know the precise part of the story he was to act out with the objects. This signal was also needed so that the sentence itself would not be integrated into the rest of the text.

No other specific verbal or signalling cues were given to subjects to initiate organization of material. The children were neither told to look for themes in the paragraphs of Experiment 2 nor were they instructed to "group" items by category in Experiment 3. The inherent structure of the material, determined by the experimenter, was intended to stimulate particular processing-organizational patterns.

3. Quantitative and Qualitative Comparisons

The number of errors as well as the type of errors made by the children was of interest in this study. Experiment 1 was defined as a screening because the learning disabled children were grouped based upon their ability to formulate strategies which were evidenced by their error patterns. Errors, then, indicated the use of comprehension strategies even though children may have been unsuccessful.

Experiment 1 has direct bearing upon Experiments 2 and 3 in that the performances of the different strategy groups were compared. This adds an interesting facet of analysis to Experiment 2. Experiment 2 emphasizes the effects of thematization upon sentence comprehension in both normal and these selected learning disabled children. It primarily focuses upon the differences

manifested between LD children who make systematic errors and LD children who do not make consistent errors.

Chapter 4 presents the data from three experiments. Experiment 1 relates to the screening procedures and the resulting LD strategy subgroups. Experiment 2 describes the effects of thematization on individual sentence comprehension while reiterating the strength of strategy sub-grouping in learning disabled children. Experiment 3 contributes supplementary information relating to the interaction of short-term memory limitations and comprehension difficulties.

Chapter 4

Comprehension Strategies, Thematization, and Memory

Experiment 1

The first experiment was undertaken not only to obtain information about the processing abilities of older children but also to consider the implications of grouping children by their abilities to formulate consistent strategies as revealed by their production of systematic errors. Though finer distinctions in terms of strategy preference (canonical order versus parallel function) may not be as crucial, it may certainly be important to consider the differences between children who do formulate strategies from those who do not. For the first analysis in this study, two general definitions were employed:

1. A "strategy user" is defined as any child whose errors indicate a consistent strategy pattern. This child shows a predominant response in his attempts to comprehend subject and object relative clause sentences.

2. An "inconsistent child" is defined as any child whose errors do not indicate a consistent strategy pattern. For the most part, this child is disorganized. He shows a mixture of processing attempts and he appears to be less able to form hypotheses about the underlying grammatical relations which exist within and between clauses.

Method

Subjects. Subjects were fifty learning disabled and twenty normal controls between the ages of 8:6 and 13:9. The mean age for the learning disabled group was 11:5. The mean age for the normally achieving group was 10:8. None of the learning disabled or normal children manifested any obvious expressive language or speech difficulties. None of the children were chosen on the basis of any specific pre-experiment language testing.

Each child was tested in a quiet room and was seated at an oval shaped school table opposite the experimenter. Each subject was told that the experimenter was doing this to complete a homework assignment for college. Subjects were informed that they were not in E's office for a test. This was particularly important for the learning disabled group.

Instructions and Materials. The nine animal objects were placed randomly at the side of the table. The instructions were as follows :

Experimenter: "We're going to play a game with the animals. I will say a sentence. Listen very carefully to the whole sentence. I want you to make the animals act out the sentence. Make sure that I am able to see exactly what each animal is doing and what is happening to each animal. I want to know who is doing what to whom."

Sentences (94) and (95) below were given to each subject to make certain that he/she understood the instructions.

(94) The zebra pushes the giraffe.

(95) The wolf bites the hippo and the bear.

Six subject relative sentences, three with subject focus (SS) and three with object focus (So), and six object relative sentences, three with object focus (OO) and three with subject focus (Os) were presented orally to each child. The subject relatives, SS and So, were subject-embedded sentences in that the relative clause interrupted the main clause. The object relatives, OO and Os, were object-non-embedded sentences in that the relative clause appeared at the end of the sentence and did not interrupt the main clause. Eight coordinate-filler sentences were also

included. The twenty sentences were presented to the children in random order.

The manipulations were noted and recorded by the experimenter on individual score sheets. They were later analyzed in terms of strategy patterns based upon the errors made by the children. Their correct responses were also noted.

The subjects had no difficulty understanding the instructions for the task. They were highly motivated and they appeared to be enjoying the activity. The learning disabled children were very familiar with the experimenter. The normal children were not. However, the normally achieving group appeared to be anxious to please and to show off for the experimenter. They also wanted to know much more about the specifics of the task than the learning disabled children. The normal children wanted to know what it was going to prove, was it for graduate school, and whether E's subject was the same thing as the psychology of language.

Results

Both qualitative and quantitative results differentiated the normal and learning disabled groups. Information about two main subgroups within the LD population was also made available. The results from the initial screening are presented first. The more formal analyses were done after this grouping was

accomplished.

A. Initial Screening

Three main strategies were isolated after considering the incorrect responses of both the normal and the learning disabled children :

1. First Noun/Actor Strategy : the first noun is the actor-doer of all actions whether the clause is on the subject or the object; this strategy overlaps with Sheldon's(1974) extraposition strategy with object sentences (such as (97) and (98) below) in that the relative clause is made to modify N-1. It also overlaps with the Parallel Function Strategy (as in (96) below).

(96) So - The giraffe that the wolf bites kicks the hippo.

Strategy- Giraffe bites the wolf/Giraffe kicks the hippo.

(97) Os - The giraffe bites the wolf that kicks the hippo.

Strategy- Giraffe bites the wolf/Giraffe kicks the hippo.

(98) OO - The giraffe bites the wolf that the hippo kicks.

Strategy- Giraffe bites the wolf/Giraffe kicks the hippo.

2. Parallel Function Strategy : the modified noun of the main clause is assumed to have the same function (subject-object) in the relative clause; this strategy overlaps with the First Noun/Actor Strategy particularly in the case of So sentences (such as (99) below). The operation of a parallel function strategy is somewhat clearer in Os sentences (such as (100) below).

(99) So - The wolf that the zebra hits kisses the lion.

Strategy- Wolf hits the zebra/Wolf kisses the lion.

(100) Os - The wolf hits the zebra that kisses the lion.

Strategy - Wolf hits the zebra/Lion kisses the zebra.

3. Temporal Order/N-V-N Strategies: the first and/or the last N-V-N grouping is assumed to be the actor-action-recipient of that sequence with the general tendency to ignore the clause boundaries; it also manifests itself as a recency strategy for the last N-V-N sequence where either the second or the last verb is used as the action of that sequence(such as (102) below). This group of temporal order strategies overlaps with parallel function strategies in that the noun chosen as the actor remains the actor for all activities(such as (102) below).

(101) SS - The lion that hits the wolk kicks the hippo.

Strategy - Lion hits the wolf/Wolf kicks the hippo.

(102) So - The lion that the wolf hits kicks the hippo.

Strategy - Wolf hits the lion/Wolf $\begin{matrix}\text{hits}\\\text{kicks}\end{matrix}$ the hippo.

Qualitative Differences. Table 2 represents the number of subjects from the original seventy children in each strategy category. Children were put into a specific strategy group based upon the predominant errors which they made on the four types of subject and object relative clause

sentences -- SS, So, OO, and Os. Correct responses served to reinforce these classifications. For example, children who were mainly employing a parallel function strategy made less errors on SS and OO sentences -- a strategy-structure match. Children who were predominantly employing a temporal-order strategy ignoring clause boundaries made less errors on Os sentences -- also manifesting a strategy-structure match.

The learning disabled children who were consistently employing comprehension strategies more frequently used First Noun/Actor and Parallel Function Strategies (LD: 12 subjects or 24% of the population). The normal children who were making errors chose a temporal-order strategy (N: 6 subjects or 30% of the population).

The Inconsistent category represents children whose errors were varied. This group consists of learning disabled children only. These children showed processing attempts which included a mixture of Parallel Function strategies, temporal-order strategies, and total confusion.

Quantitative Differences. The normally achieving children performed superiorly to the learning disabled group. Sixty-five per cent of the normal subjects obtained perfect or near-perfect (one error) scores. Only eighteen per cent of the learning disabled children obtained the same high scores.

TABLE 2

THE STRATEGY PREFERENCES OF FIFTY LEARNING DISABLED AND TWENTY NORMALLY ACHIEVING CHILDREN ON THE COMPREHENSION OF FOUR TYPES OF RELATIVE CLAUSE SENTENCES

STRATEGY SUBGROUP	GROUP	NUMBER OF CHILDREN	PERCENTAGE OF CHILDREN
100 Per cent or 1 error	LD	9	18
	Normal	13	65
First Noun/ Actor and Parallel Function	LD	12	24
	Normal	1	5
Temporal Order	LD	7	14
	Normal	6	30
Inconsistent	LD	22	44
	Normal	0	0

B. Final Groups

The twelve learning disabled subjects who used a First Noun/Actor and Parallel Function Strategy were combined with the seven learning disabled subjects who preferred a temporal-order strategy. One LD subject who obtained less than 100% (making one error) was randomly added to form a group of twenty learning disabled children. These subjects were defined under the general heading of "Strategy Users" (LD-1). Of the twenty-two subjects who were originally defined as Inconsistent, two were randomly dropped to form a group of twenty subjects. They remained defined under the general heading "Inconsistent" (LD-2). The group of twenty normally achieving children remained intact.

The mean age for the Strategy Users was 11:7 with a range of 9:7 - 13:9. The mean age for the Inconsistent group was 11:3 with a range of 8:8 - 13:2. The mean age for the normally achieving group was 10:8 with a range of 8:6 - 13:9.

The eight learning disabled children who obtained perfect or near-perfect scores were eliminated from the formal analysis. They were eliminated because this investigation was mainly concerned with comparing the

performances of LD children who made consistent errors with the performances of LD children who made inconsistent errors. Thus, three LD subgroups were recognized--LD children who obtained perfect or near perfect scores, LD children who made systematic errors, and LD children who made inconsistent errors. Two groups--the LD Strategy Users (making strategic mistakes) and the LD Inconsistents--were evaluated. The LD children, who did not make errors, comprise another population of LD children for future consideration. Thus, any claims made here do not necessarily generalize to all learning disabled children.

Results

A (3) x (4) analysis of varience was performed on the main effects of GROUP (Strategy Users vs. Inconsistents vs. Normals) and SENTENCE TYPE (SS vs. So vs. OO vs. Os). The first is a between group variable; the latter is a within subjects variable.

Both main effects were found to be significant: GROUP, $F(2,114)= 51.57$; $p<.001$; TYPE, $F(3,114)= 12.84$; $p<.001$.

The normal children performed better than both the LD Strategy Users and the LD Inconsistent children.

LD-Strategy Users and LD-Inconsistents did not quantitatively differ from each other. For no sentence type did the two groups differ. Both learning disabled groups, however, differed significantly from the normal group (LD-Strategy Users vs. Normal, $t(158) = -7.26$, $p < .001$; LD-Inconsistent vs. Normal, $t(158) = -9.01$, $p < .001$).

The hierarchy of difficulty from easiest to most difficult sentence type was : SS, OO, Os, and So. (Refer to Table 3) The difference between the means for SS and So sentences, representing the highest and lowest mean number of correct responses, was confirmed as a significant one (SS vs. So, $t(118) = 5.04$, $p < .001$). The difference between the means for OO and Os sentences was not significant. Finally, SS and So means were significantly different from both object means, i.e., OO and Os means (SS vs. OO, $t(118) = 2.02$, $p < .05$; SS vs. Os, $t(118) = 2.02$, $p < .05$; So vs. OO, $t(118) = -3.01$, $p < .003$; So vs. Os, $t(118) = -2.67$, $p < .009$). Thus, subject relatives differed from object relatives. The subject relatives also differed from each other. Subject relatives with subject focus (SS types) were found to be easier than subject relatives with object focus (So types).

The GROUP x SENTENCE TYPE interaction was also found to be significant: $F(6,114) = 2.96$; $p < .01$. Table 3 illustrates the mean number of correct responses on the four types of relative clause sentences by the three groups of children--the LD-Strategy Users, the LD-Inconsistents, and the normal children.

The normal children obtained higher scores on both OO and Os relatives, the object relatives with object and subject focus respectively. The learning disabled children obtained higher scores on the subject relatives with subject focus (SS types). The subject relatives with object focus, the So sentences, remained the most difficult for both groups. As the correct responses of the LD-Strategy Users and the LD-Inconsistents did not pattern differently, the processing hierarchy is viewed in terms of the general differences between the normally achieving and these selected learning disabled children. The mean number of correct responses for the two groups from highest to lowest is:

a) Normal Children - OO...Os...SS...So

b) LD Children - SS...OO...Os...So

TABLE 3

THE MEAN NUMBER OF CORRECT RESPONSES OF SIXTY CHILDREN ON A SENTENCE PROCESSING TASK AS A FUNCTION OF TYPE OF RELATIVE CLAUSE SENTENCE x STRATEGY GROUP

GROUPS	SENTENCE TYPES				
	SS	So	OO	Os	Mean
LD-Strategy Users N = 20	.683	.300	.555	.467	.496
LD-Inconsistents N = 20	.733	.250	.400	.400	.446
Normals N = 20	.850	.716	.967	1.000	.883
Mean	.756	.422	.633	.622	

Discussion

The results of Experiment 1 lend support to the more general hypothesis of this study, Hypothesis 1, which indicated that both the number (quantitative) and the type (qualitative) of comprehension errors would differentiate the two groups. The normally achieving children after about the age of nine-and-a-half obtained perfect or near-perfect scores on the four types of relative clause sentences. A much higher proportion of normal children obtained perfect or near-perfect scores than did the LD children. Generally, the LD children did not perform as well as the normal children. Among the LD children who made strategic errors, different strategy preferences were revealed when they were compared with the normal children. Additionally, there was a large percentage of LD children who were inconsistent.

The errors made by the normal group clustered on the subject relatives, the SS and So sentences. These results provide some evidence for the Interruption Hypothesis discussed by Miller(1962) and Slobin(1971). The performances of the learning disabled group, who obtained low scores on the object relatives, the OO and Os sentences, do not lend support to the Interruption Hypothesis. Non-interruption did not prove to be

facilitating to comprehension for the LD groups studied here. The parallel function of a subject-first noun in conjunction with canonical order within the relative clause apparently was facilitating for the learning disabled children. Indeed, even the inconsistent LD children manifested their strongest performances on the subject relatives with subject focus--the SS sentences. The results with the LD group are indicative of the same pattern reported by Sheldon(1974). She indicated that three to five-year-olds employ the Parallel Function Strategy successfully on subject relatives with subject focus (SS relatives) before they successfully apply this strategy to the object relatives with object focus (OO relatives).

The strength of a First Noun/Actor Strategy is also supported from the general findings. Evidence for the operation of a more all-encompassing temporal-order strategy is indicated mainly by the performances of the younger normally achieving children. However, it is more difficult to make a strong case for comprehension strategy preference for the normal children in view of the general ceiling effect in this group after about the age of nine-and-a-half.

It might be said that older normally achieving

children and the LD children who obtained perfect and near-perfect scores are using competency-based strategies, i.e., a knowledge of the grammar plus comprehension strategies. The LD-Strategy Users and the normals who make errors appear to be employing consistent strategies which are not competency-based. Their knowledge of the grammar is still inadequate. The LD-Inconsistents have not yet developed consistent strategies. Their knowledge of the grammar and their application of strategies are both limited.

It seems remarkable that the LD-Strategy Users perform no better than the LD-Inconsistent children. This conclusion is based upon quantitative results. Nevertheless, the type of errors made by these two learning disabled subgroups indicates information processing differences. There must be more to say about the child who organizes incoming information from the child who does not. The implications of these differences needs further investigation.

Experiment 1 has isolated different comprehension strategy subgroups within the learning disabled population. The question remains as to whether these qualitative differences relate to other language and processing performances.

Experiment 2

The comprehension abilities of learning disabled

children who formulate consistent strategies and learning disabled children who do not formulate consistent strategies were further explored. This experiment provides an opportunity to consider a child's processing strategies in relation to his ability to utilize prior context. Experiment 2 provides information about the role of thematization upon sentence comprehension.

Procedure

Subjects. Subjects were the same sixty children grouped in Experiment 1--twenty LD-Strategy Users, twenty LD-Inconsistents, and twenty normal children.

Each group was split into two subgroups, A and B, so that stimuli could be counterbalanced. Thirty subjects received Stimuli A and thirty subjects received Stimuli B.

Instructions and Materials. Each child was tested in the same room by the same experimenter. Subjects were informed again that this was not a test. They were told that E wanted to finish her assignment for college.

Though a total of twenty-four doll objects were employed in the task, only nine objects (the same number used in Experiment 1) were placed randomly in front of the child at a time. Each subject was familiarized with the objects to make certain that they were easily recognizable. The instructions were as follows:

Experimenter: "We're going to listen to a few short stories. Listen very carefully to each story because I want you to act out the ending of the story with the objects. You will hear a bell when the end of the story is coming. This will be your signal to get ready. Make sure that I can see exactly what is happening in the story. I want to know who is doing what to whom."

The last sentence of each story was a subject or an object relative clause sentence. The stories and final sentences were recorded by E and presented on tape. Each child received eight stories with eight final sentences, one of each experimental type. Four stories were thematized and four were nonthematized.

Thematization was counterbalanced so that each paragraph appeared in its thematized version for one group of children and its nonthematized version for the other group. The resulting sixteen paragraphs and eight target sentences are reproduced in Appendices B and C.

The following warm-up story was given to each child to insure that there was no difficulty with the instructions:

The Animals

It was a beautiful day in the jungle. The sun was shining and the sky was blue. The hippo was in the water, the lion was sitting under a tree, and a giraffe was running in the grass. But, all of a sudden, there was a terrible noise...SIGNAL...An alligator was chasing the hippo out of the water.

The children understood the task. They also appeared to be enjoying the stories. Though it was impossible to measure, the children also appeared to be attending to the stories. No errors were made due to misinterpretation of instructions. Misinterpretations could have resulted in object manipulations of the whole story or manipulations involving the acting out of incorrect parts of the story.

Results

Introductory Summary. The results indicate that the comprehension of relative clause sentences can be differentially affected by prior context. However, the presentation of thematized contexts before sentences, i.e., stories which contain a main character, did not provide a uniform effect. Thematization did not have the same effect on subject and object relatives. Thematized prior contexts had the greatest effect on the subject relatives -- both So and SS types.

Both qualitative and quantitative results differentiated the normally achieving and the learning disabled populations. The LD subgroups, the Strategy Users and the Inconsistent children, also performed differently from each other. The nature of the differences between the two learning disabled subgroups was often more subtle than obvious.

A. Initial Analysis

The first (3) x (2) x (2) x (4) analysis of variance was performed on the main effects of

GROUP (LD-Strategy Users vs. LD-Inconsistent vs. Normal), SUBGROUP (A vs. B), THEMATIZATION (Thematized vs. Non-thematized), and SENTENCE TYPE (SS vs. So vs. OO vs. Os). No difference was found between A and B subgroups, representing the counterbalanced stimuli, so those data are collapsed in Table 4 which displays the raw scores and the mean number of correct responses in each condition.

The main effects of GROUP and SENTENCE TYPE were found to be significant: GROUP, $F(2,54)= 36.21$; $p<.001$; TYPE, $F(3,54)= 5.48$; $p<.003$.

Group(LD-Strategy Users vs. LD-Inconsistent vs. Normal). Post hoc t-tests indicated that the two learning disabled groups did not differ significantly. However, both LD-Strategy Users and LD-Inconsistents differed significantly from the normals (LD-Strategy Users vs. Normal, $t(318)= -5.24$; $p<.001$; LD-Inconsistents vs. Normal, $t(318)= -6.24$; $p<.001$).

Type(SS vs. So vs. OO vs. Os). Mean differences between the two subject relatives, the SS and So types, (the mean number correct was identical, i.e., .600 for both) was not significant. The two object relatives, the OO and Os types, also did not differ significantly. Both subject relatives, SS and So, were significantly

TABLE 4

THE RAW SCORES AND MEAN NUMBER OF CORRECT RESPONSES OF FORTY LEARNING DISABLED AND TWENTY NORMAL CHILDREN AS A FUNCTION OF GROUP, THEMATIZATION, AND SENTENCE TYPE

GROUPS		THEMATIZED				NON-THEMATIZED				
		SS	So	OO	Os	SS	So	OO	Os	
LD-Strategy Users N= 20	f	6	14	15	10	16	8	13	15	97
	$\bar{X}$	.300	.700	.750	.500	.800	.400	.650	.750	.606
LD-Inconsistent N= 20	f	6	10	13	15	12	8	8	13	85
	$\bar{X}$	.300	.500	.650	.750	.600	.400	.400	.650	.531
Normal N= 20	f	15	19	17	19	17	13	19	18	137
	$\bar{X}$	.750	.950	.850	.950	.850	.650	.950	.900	.856
Totals	f	27	43	45	44	45	29	40	46	
	$\bar{X}$	.450	.717	.750	.733	.750	.483	.666	.766	
	$\bar{X}$ .663 (Theme)					$\bar{X}$ .675 (Non-Theme)				

different from the object relatives with subject focus, the Os types (SS vs. Os, $t(238) = -2.50$; $p < .01$; So vs. Os, $t(238) = -2.50$; $p < .01$). The difference between the subject relatives and the object relatives with object focus, the OO types, only approached significance (SS vs. OO; $t(238) = -1.77$; $p < .07$; So vs. OO, $t(238) = -1.77$; $p < .07$).

The main effect of THEMATIZATION was not significant. However, the significant TYPE x THEMATIZATION and TYPE x GROUP x THEMATIZATION interactions provide additional information about the complicated nature of the effects of prior context upon sentence comprehension.

1) TYPE x THEMATIZATION, $F(3,54) = 11.9$; $p < .001$. Performances on SS and So relatives were particularly affected by whether they appeared after thematized or non-thematized stories. Comprehension of SS relatives was better after nonthematized stories. The opposite was true for So relatives, comprehension of So relatives being better after thematized stories. Comprehension differences for the object relatives were in a similar direction but were not nearly as great. Performance on Os relatives was somewhat better after nonthematized stories. Comprehension of the OO relatives tended to be better after thematized stories. Post hoc

t-tests confirmed that it was the performances on the subject relatives which were providing the particular effect of thematized and non-thematized conditions across the variable of sentence type (SS-Theme vs. Non-theme, $t(118) = -3.49$; $p < .001$; So-Theme vs. Non-theme, $t(118) = 2.66$; $p < .009$).

2) TYPE x GROUP x THEMATIZATION, $F(6,54) = 2.58$; $p < .03$. This significant three-way interaction yielded the following information:

The Subject Relatives

(a) SS - The overall poorer performances on the SS sentences after thematized stories is due mainly to the performances of the LD children--especially the LD-Strategy Users. The performances of the normal children on SS types after thematized and non-thematized stories were not significantly different (SS-Theme vs. Non-theme:LD-Strategy Users, $t(38) = -3.58$; $p < .001$; SS-Theme vs. Non-theme: LD-Inconsistents, $t(38) = -1.95$; $p < .05$).

(b) So - The overall improved performances on the So sentences after thematized stories is due to the combined performances of the LD-Strategy Users and the normally achieving

children. The normal children were most affected by thematized and non-thematized contexts before So relatives. A key result here is that the LD-Inconsistent children performed similarly on So types regardless of whether the So relatives were preceded by thematized or non-thematized contexts(So-Theme vs. Non-theme:Normals, $t(38) = 2.49$; $p < .01$; So-Theme vs. Non-theme:LD-Strategy Users, $t(38) = 1.95$; $p < .05$).

The Object Relatives

Scores tended toward the predicted directions on the object relatives. The effects of thematized and non-thematized contexts upon comprehension are noted by the poor performance of the LD-Inconsistent children on OO sentences following non-thematized paragraphs and the poor performance of the LD-Strategy Users on the Os sentences following thematized paragraphs.

B. Key Analyses

The results thus far indicate that the comprehension of a sentence can be affected by prior

information received by a listener. However, the presentation of thematized contexts before sentences did not have a uniform facilitating effect upon comprehension. Indeed, performances on the SS relatives was shown to be better after stories without themes, i.e., after the non-thematized condition.

The effect of thematized and non-thematized contexts upon the comprehension of subject and object relatives becomes clearer by considering the grammatical function of the thematized referent. Indeed, the unrelativized NP was arbitrarily chosen as the thematized referent for the thematized stories. Thus, SS and Os relatives both appear after stories which contain an object which has been thematized. So and OO relatives both appear after stories which contain a subject which has been thematized. Sentences (103) and (104) below provide examples of SS and OO sentences respectively. Sentence (103) indicates an object referent which becomes the theme. Sentence (104) indicates a subject referent which becomes the theme.

(103) The indians that captured the Chief killed the medicine man. (SS)

(104) The Lieutenant found the engineer that the Captain screamed for. (OO)

Table 5 illustrates the mean number of correct responses on subject and object thematizations. The

REFERENT x THEMATIZATION interaction was found to be significant, $F(1,38)= 28.6$; $p<.001$, allowing the following generalization: Subject thematization appears to be facilitating to comprehension while object thematization appears to have a non-facilitating effect. An almost perfect reversal of mean number correct on thematized and non-thematized subject-object sentence counterparts results (See Table 5).

Table 6 illustrates the mean number of correct responses of the learning disabled and normally achieving groups as a function of REFERENT (Subject vs. Object), GROUP (LD-Strategy Users vs. LD-Inconsistents, vs. Normals), and THEMATIZATION (Thematized vs. Non-thematized). The three-way interaction REFERENT x GROUP x THEMATIZATION was found to be significant, $F(2,38)= 4.74$; $p =<.01$, indicating that: The particular effect of subject themes and object themes was not a uniform one across groups. Subject themes appear to provide a more facilitating effect upon comprehension while object themes appear to have more of a non-facilitating effect upon comprehension. Further analysis of the particular errors made by the children is warranted.

TABLE 5

MEAN NUMBER OF CORRECT COMPREHENSION RESPONSES OF FORTY LEARNING DISABLED AND TWENTY NORMAL CHILDREN ON FOUR TYPES OF RELATIVE CLAUSE SENTENCES AS A FUNCTION OF GRAMMATICAL FUNCTION OF THE THEMATIZED REFERENT AND THEMATIZATION

FUNCTION OF THE THEMATIZED REFERENT	THEMATIZED	NON-THEMATIZED
Subject(So and OO)	.733	.591
Object (SS and Os)	.591	.758

TABLE 6

MEAN NUMBER OF CORRECT RESPONSES OF TWENTY LD-STRATEGY USERS, TWENTY LD-INCONSISTENTS, AND TWENTY NORMAL CHILDREN ON A PRIOR CONTEXT-SENTENCE COMPREHENSION TASK AS A FUNCTION OF THEME REFERENT x GROUP x THEMATIZATION

REFERENT	GROUP	PRIOR CONTEXT	
		Thematized	Non-Thematized
Subject (So and OO)	LD-Strategy Users	.725	.525
	LD-Inconsistents	.630	.450
	Normals	.900	.800
Object (SS and Os)	LD-Strategy Users	.400	.775
	LD-Inconsistents	.525	.625
	Normals	.850	.875

C. Qualitative Results

The purpose of this analysis was to study any comprehension changes which occurred due to the presentation of thematized and non-thematized prior contexts. This provided an opportunity to gain additional insight into the complex interrelationship between given semantic information and sentence comprehension. Table 7 provides a summary of the number of errors made on each sentence type after thematized and non-thematized stories by the three groups of children.

The object manipulation responses of all sixty children were recorded and analyzed in terms of error patterns. A comparison was made of each subject's performance after thematized and non-thematized conditions.

Introductory summary of results. Sentences were processed differently after thematized stories than they were after non-thematized stories. Errors indicated that the thematized referent of the stories became the central focus in the children's comprehension attempts. Additionally, the thematized referents tended to be interpreted as subject-actors in the sentences. Subject thematizations, i.e., instances in which the thematized referent was a subject in its relative clause,

TABLE 7

THE NUMBER OF ERRORS MADE ON FOUR TYPES OF RELATIVE CLAUSE SENTENCES BY FORTY LEARNING DISABLED AND TWENTY NORMAL CHILDREN AFTER THEMATIZED AND NON-THEMATIZED STORIES

GROUPS	SENTENCE TYPES							
	SS		So		OO		Os	
	Obj Them	Non-Them	Subj Them	Non-Them	Subj Them	Non-Them	Obj Them	Non-Them
LD-StrategyUser N= 20	14	4	6	12	5	7	10	5
LD-Inconsistent N= 20	14	8	10	11	7	11	5	7
Normal N= 20	5	3	1	7	3	1	1	2

produced a facilitating effect upon comprehension. Object thematizations, i.e., instances in which the thematized referent was an object in its relative clause, had a generally non-facilitating effect upon comprehension. Both of these effects of thematization were strongest for the subject relatives, the So and SS types. The strategies employed after the non-thematized stories were similar to those employed in the no-context situation, i.e., in Experiment 1.

The LD Strategy Users were the most affected by the thematized variable. In general, the LD-Inconsistent children were not as negatively affected by the object thematizations as were the LD Strategy Users. The normally achieving children performed significantly better than both learning disability groups. Their comprehension performances improved on So relatives which appeared after subject thematizations. The normal children were not negatively affected by any of the prior contexts. In summary, for the normals, the effect was only to facilitate comprehension. For the LD Strategy Users, the effect of thematization was both facilitating and non-facilitating. For the LD Inconsistent children, the effect was not a clear-cut.

Comprehension strategies after non-thematized stories. Non-thematized stories did not contain one central character. Each of the three nouns from the relative clause sentence was mentioned only once. This equal distribution should provide an equal opportunity for each of the nouns to remain salient in memory. Comprehension of the relative clause sentences should not necessarily change in any way. However, the fact that these complex sentences followed a story's context could have provided a facilitating effect upon their comprehension. The discussion will follow on the errors made on these types of sentences.

A. The Subject Relatives

SS - Subject relatives with subject focus

(105) The indians that captured the Chief killed the medicine man.

So - Subject relatives with object focus

(106) The nurse that the doctor pushed bumped into the tennis player.

The LD Strategy Users employed N1/Actor-Parallel Function strategies after non-thematized stories for SS and So sentences. The "indians" (105) and the "nurse" (106) were manipulated as the actor of all actions. Only four LD Strategy Users made errors on SS types. These included errors involving

recency strategies, i.e., "The indians captured the Chief and the Chief killed the medicine man." So sentences remained difficult for the LD Strategy Users. Twelve children from this group employed N1/Actor and temporal order strategies on So sentences manifesting their no-context strategies in Experiment 1.

The LD Inconsistent children made a variety of errors on both SS and So sentences. Non-thematized contexts did not affect their comprehension either. Eight LD Inconsistent children made errors on SS sentences which included more general confusions and omissions. So sentences remained as difficult as they were in the no-context condition in Experiment 1. The LD Inconsistent children showed a mixture of N1/Actor, temporal order, and confusion errors. Eleven LD Inconsistent children made errors on So sentences after non-thematized stories.

The normal children also tended to use the same strategies that they used on Experiment 1 sentences after the non-thematized stories. Only three normal children made errors on SS sentences. Seven children made errors on the So types. The normal children made errors involving temporal

order/recency strategies. For example, So sentences tended to be interpreted in this way: "The nurse pushed the doctor and the doctor bumped into the tennis player." Thus, SS sentences tended to be much easier to process than So sentences in the non-thematized condition.

B. The Object Relatives

OO - Object relatives with object focus

(107) The Lieutenant found the engineer that the Captain screamed for.

Os - Object relatives with subject focus

(108) The King touched the Prince that killed the Queen.

The LD Strategy Users tended to employ N1/Actor, Parallel Function, and temporal order strategies for OO and Os sentences after non-thematized stories. They tended to use the same strategies manifested in Experiment 1. Seven LD Strategy Users made errors on OO types. A common strategy employed for OO sentences was N1/Actor: "The Lieutenant found the engineer and the Lieutenant screamed for the Captain." Five LD Strategy Users made errors on Os sentences, interpreting the "King" as the actor of all actions: "The King touched the Prince and the King killed the Queen."

The LD Inconsistent children made eleven

errors on OO sentences and seven errors on Os sentences. They tended to substitute nouns randomly. They also had difficulty finding the correct NP for the relative clause. Three of the LD Inconsistent subjects omitted the relative clause in the OO type. They tended to manipulate the objects for the first part of the sentence, i.e., "The Lieutenant found the engineer...." The seven LD Inconsistent children who made errors on the Os sentences tended to manifest general confusions.

The normally achieving children, obtaining almost a ceiling effect, made a total of three errors on the object relatives after non-thematized stories (one error on OO and two errors on Os).

Comprehension strategies after thematized stories.

Thematized stories contained a main character. This referent was mentioned three times. The events in the story are seen through the eyes or the activities of this character. This should bring additional attention to the thematized referent. It should also provide some perceptual salience for that referent in memory. The thematized referent was the subject in So and OO relatives; it was an object in SS and Os sentences. All thematized referents became the subject-actors within

the stories. A subject referent when thematized (as in So and OO) provides the listener with accurate information about the underlying relations of that referent. It is the subject in the story and a subject in the sentence. An object referent when thematized (as in SS and Os) provides the listener with less precise information. This happens because the object noun from the sentence becomes the subject in the story. Thus, what remains salient in memory may be the thematized referent and information about its underlying function.

The underlined noun in all the sentences below points out the thematized referent.

A. The Subject Relatives

SS sentences contained object referents which were thematized.
So sentences contained subject referents which were thematized.

SS - Subject relatives with subject focus

(109) The indians that captured the Chief killed the medicine man.

So - Subject relatives with object focus

(110) The nurse that the doctor pushed bumped into the tennis player.

The LD Strategy Users were quite affected by thematization. For both SS and So sentences the thematized noun became an important character in their

object manipulations. This resulted in an increased number of errors on SS sentences and better performances on So sentences. For example, the thematized noun, "Chief," was used as an inappropriate subject-actor in SS sentences. Nine out of the fourteen LD Strategy Users who made errors indicated : "The indians captured the Chief and the Chief killed the medicine man." The "Chief" is substituted for the "indians." These nine children had employed a N1/Actor strategy on SS sentences which followed a non-thematized story. Thematizing the noun "doctor" in So sentences, however, appeared to help the LD Strategy Users to resolve the difficulty with the N-1 (nurse) - N-2 (doctor) relationship. The "doctor," as the subject in the story becomes the subject in the sentence. This results in correct responses when the strategy is not over-employed. The manipulations include: "The doctor pushes the nurse and the nurse bumps into the tennis player." Of the six LD Strategy Users who made errors on So sentences after thematized stories, four of them overused the thematized noun. Manipulations included: "The doctor pushes the nurse and the doctor bumps into the tennis player." "The doctor" (underlined) is substituted for "the nurse."

The LD Inconsistent children were also affected by thematization. Their strategies manifested a greater

degree of organization after the thematized stories than they did after the non-thematized stories and in the no-context situation (Experiment 1). The thematized noun also became more of a central focus of their object manipulations. Of the fourteen LD Inconsistent children who made errors on SS sentences, twelve overused the thematized noun in some way. One strategy employed by the LD Inconsistent children on SS sentences involved making the thematized noun watch or comment. For example, the children would pick up "the Chief" (SS thematized noun) and put him aside. Then that character would say something such as "Look at the fighting" or "The tribe is angry" as "The indians kill the medicine man." Another strategy involved using the thematized noun as the actor of all activities. For example, "The Chief captured the medicine man and the Chief killed the indians." A third strategy used by the LD Inconsistent children involved the same one employed by the LD Strategy Users on SS sentences after thematized stories. This included using the thematized noun as an inappropriate subject while maintaining N-1 as the actor. For instance, "The indians captured the Chief and the Chief killed the medicine man." The "chief" (underlined) is substituted for the "indians." Comprehension of So sentences after thematized stories were not as improved as the performances of the

LD Strategy Users. Nevertheless, the strategies employed by the LD Inconsistent children showed changes in organization. Of the ten LD Inconsistent children who made errors on the So sentences, nine overused the thematized noun. The major strategy employed here involved making the thematized noun, "the doctor," the actor of all activities. For example, "The nurse that the doctor pushed bumped into the tennis player" became "The doctor pushed the nurse and the doctor bumped into the tennis player." The "doctor" (underlined) is substituted for the "nurse."

The normal children performed almost equally well on SS sentences after thematized and non-thematized stories. Of the five children who made errors on SS sentences after thematized stories, three of them overused the thematized noun in some way. For example, "The indians that captured the Chief killed the medicine man" became "The Chief killed the medicine man and the Chief captured the indians" or "The indians captured the Chief and the Chief killed the medicine man." However, the normal children obtained near-perfect performances on the So relatives after the thematized stories. Only one normal subject made an error on an So sentence in the thematized condition as compared to seven errors which were made on So sentences in the non-thematized condition.

Thus, the LD Strategy Users and the normally achieving children performed better on So sentences after thematized stories. The thematized referent, "doctor," became the appropriate subject-actor of the first action in the relative clause sentence. The LD Inconsistent group improved on So sentences after thematized stories in terms of organization and strategy changes manifested in their processing attempts. The two learning disabled groups tended to overapply the thematized noun as a subject-actor in the final sentences of the thematized stories. In this case, the SS sentences were affected in negative directions.

B. The Object Relatives

OO sentences contained subject referents which were thematized.
Os sentences contained object referents which were thematized.

OO - Object relatives with object focus

(111) The Lieutenant found the engineer that the Captain screamed for.

Os - Object relatives with subject focus

(112) The King touched the Prince that killed the Queen.

The pattern of errors for both learning disabled groups indicated that the thematized noun was given more focus in their object manipulations. This was true for both OO and Os relatives. Both LD Strategy Users and

LD Inconsistent children performed better on OO sentences which followed subject thematizations. More errors were made on OO sentences in the non-thematized condition. As with the SS sentences after object thematizations, the LD Strategy Users had more difficulty comprehending Os relatives after the object thematizations. The LD Strategy Users performed better on Os sentences after non-thematized stories. The LD Inconsistent children were not as negatively affected by object thematizations. Their performances on Os sentences were about the same in the thematized and the non-thematized conditions. Of the five LD Strategy Users, who did make errors on the OO sentences, four of them overused the thematized noun as a subject. Manipulations included: "The Captain found the engineer and the Captain screamed for the Lieutenant " instead of the correct sentence "The Lieutenant found the engineer that the Captain screamed for." The LD Strategy Users appear to be modifying their N1/Actor and parallel function strategies by substituting the thematized noun as the actor of all actions. Ten LD Strategy Users made errors on the Os relatives in the thematized condition. They tended to use the thematized noun, "Queen", an object, as an inappropriate subject. Manipulations included: "The King touches the Prince and the Queen kills the Prince" instead of the correct sentence : "The King touches the Prince that kills the Queen."

The LD Inconsistent children tended to show more organization in their comprehension of OO and Os sentences in the thematized condition. The thematized noun was always included in their manipulations. The three LD Inconsistent children who had omitted the relative clause in OO sentences after the non-thematized stories included the relative clause in their manipulations after the thematized stories. For instance, "The Lieutenant found the engineer that the Captain screamed for" was interpreted as: "The Captain screamed for the Lieutenant and the Lieutenant...(omission)." Manipulations for OO sentences on the non-thematized side included: "The Lieutenant found the engineer...(omission)" for the correct sentence "The Lieutenant found the engineer that the Captain screamed for." Another strategy employed by the LD Inconsistent children on OO sentences after thematized stories involved making the thematized noun watch or comment. This strategy was similar to the one they used on SS sentences after thematized stories. For example, the children would pick up "The Captain" (OO thematized noun) and put him aside. Then "the Captain" would say something such as "Help me, help me" as "The Lieutenant finds the engineer." The performances of the LD Inconsistent children on the Os relatives in the thematized condition indicated a most striking difference between that learning disabled group

and the LD Strategy Users. Only five LD Inconsistent children made errors on Os sentences after object thematizations. Ten LD Strategy Users made errors on Os sentences after object thematizations. The LD Inconsistent children who did make errors on Os sentences tended to overuse the thematized noun in some way. Thus, the Inconsistent group tended to be more consistent with the help of thematized prior contexts. They were not as negatively affected, however, by object thematizations as were the LD Strategy Users.

The normally achieving children, obtaining almost a ceiling effect, made a total of four errors on the object relatives after thematized stories (three errors on OO sentences and one error on Os sentences). Their performances in terms of strategy choices and number of errors generally remained unchanged between thematized and non-thematized contexts.

Experiment 2 provided information about the effects of prior context upon comprehension. It also showed that the two learning disabled groups performed differently from each other. The implications of these comprehension processing differences needs further investigation. Indeed, what other performance differences can be shown to exist between these two groups of learning disabled children?

Experiment 3

This experiment provided an opportunity to study the interaction of short-term memory variables with more general abilities to formulate comprehension strategies. Experiment 3 also considered the tendency of listeners to spontaneously employ a clustering strategy, i.e., grouping words by category, in tasks involving the free recall of word lists.

Procedure

Subjects. Subjects were the same sixty children used in Experiment 1 and Experiment 2 -- twenty LD Strategy Users, twenty LD Inconsistents, and twenty normally achieving children.

Tasks. Two short-term memory tasks, the free recall of word lists and digit span, were completed with all the children. Each child was tested individually by the same examiner in the same testing room.

A. Free Recall of Word Lists (Clustering)

Materials and Instructions. Subjects were informed that this was not a test. They were told that this was the last part of E's assignment for college. Each child was presented with one clusterable and one non-clusterable list. A clusterable list had words which were related by category, i.e., animals, vehicles, body parts. A

non-clusterable list contained words which were not related by category. Four word lists were constructed so that the clusterable-non-clusterable stimuli could be counterbalanced for order of presentation and any peculiarities in vocabulary, etc. Thirty subjects received a clusterable list first and thirty subjects received a non-clusterable list first. Lists were recorded by the experimenter with one-second intervals between words. The lists were presented to each subject on tape. The instructions were as follows:

Experimenter: "You are going to hear a list of words. Listen very carefully. At the end of the list, I want you to tell me as many words as you can remember from that list."

A practice list of four words -- chair, pen, school, boy -- was given to each child to make certain that he/she understood the instructions.

A complete copy of the clusterable and non-clusterable lists is reproduced in Appendix D.

Results

A (2) x (2) x (3) analysis of variance was performed on the following main effects: LIST FORM (Clusterable vs. Non-Clusterable); ORDER OF PRESENTATION (Clustered First-A vs. Clustered Second-B); GROUP (LD Strategy Users, LD Inconsistents, vs. Normal). Table 8 illustrates the number of correct items recalled as a function of these

three experimental variables. Table 9 illustrates the total mean number of items recalled by the three groups of children.

The only significant main effect was that of GROUP, $F(2,2)= 19.02$; $p<.05$.

One two-way interaction, LIST FORM x ORDER of PRESENTATION, was also found to be significant, $F(1,2)= 17.58$; $p<.05$. Clusterable lists when presented first resulted in better performances overall.

A case could not be made for better performances due to a clustering strategy. Initial analysis plus t-tests indicated that the mean number of clusters used by the three groups of children was not significantly different (Mean number of Clusters: Normals, $\bar{X}= 1.45$; LD-Strategy users, $\bar{X}= 1.25$; LD-Inconsistent, $\bar{X}= 1.00$. Raw scores, summarizing the total number of clusters spontaneously used by each group, suggested a difference (Number of Clusters: Normals = 29; LD-Strategy Users = 25; LD-Inconsistent = 20).

Post hoc t-tests were done on the Clustered list-First group. These children had performed better overall. The LD Strategy Users were not significantly different from the normally achieving children. The performance of the LD Inconsistent children was significantly

TABLE 8

THE NUMBER OF ITEMS RECALLED BY FORTY LEARNING DISABLED AND TWENTY NORMAL CHILDREN AS A FUNCTION OF CLUSTERING, ORDER OF PRESENTATION, AND STRATEGY SUBGROUP

GROUPS	ORDER OF PRESENTATION	LIST TYPE	
		Clusterable	Non-Clusterable
LD-Strategy Users N= 20	Clustered List First	59	47
	Clustered List Second	47	51
LD-Inconsistents N= 20	Clustered List First	49	43
	Clustered List Second	50	51
Normals N= 20	Clustered List First	65	60
	Clustered List Second	51	63

TABLE 9

THE MEAN NUMBER OF ITEMS RECALLED BY FORTY LEARNING DISABLED AND TWENTY NORMAL CHILDREN ON CLUSTERABLE AND NON-CLUSTERABLE WORD LISTS

GROUPS	LIST TYPES		
	Clusterable	Non-Clusterable	Total
LD-Strategy Users N= 20	53	49	51
LD-Inconsistents N= 20	49.5	47	48.2
Normals N= 20	58	61.5	59.7

different from that of the LD Strategy Users and the normally achieving children (Normal vs. LD-Inconsistents, $t(18) = -4.15$; $p < .001$; LD-Strategy Users vs. LD-Inconsistents, $t(18) = 2.03$; $p < .05$). Thus, in view of the Clustered List-First advantage, the normally achieving children and the LD Strategy Users performed equally well. The LD Inconsistent children recalled significantly fewer items than the other two groups. (Total number of words recalled: Normal = 65; LD-Strategy Users = 59; LD Inconsistent children = 49)

B. Auditory Sequential Memory (Digit Span)

The Auditory Sequential Memory subtest of the Illinois Test of Psycholinguistic Abilities was administered to all sixty children. Table 10 illustrates the percentage of children in each group who scored above/on and below chronological age levels for each group.

Results

The results provide additional information about the different processing abilities of the three groups of children. The normally achieving subjects, with the exception of two children, all performed above or on age level on the digit span test. The LD Strategy Users split their performances. Half

TABLE 10

THE PERCENTAGE OF LEARNING DISABLED AND NORMAL CHILDREN WHO SCORED ABOVE-ON AND BELOW AGE LEVEL ON THE AUDITORY SEQUENTIAL MEMORY SUBTEST OF THE ILLINOIS TEST OF PSYCHOLINGUISTIC ABILITIES

GROUPS	CHILDREN SCORING ABOVE/ON AGE LEVEL		CHILDREN SCORING BELOW AGE LEVEL	
	Number	Percentage	Number	Percentage
LD-Strategy Users N= 20	10	50	10	50
LD-Inconsistents N= 20	1	5	19	95
Normals N= 20	18	90	2	10

the children scored on or above age level and half the children scored below age level. The LD Inconsistent children had only one subject, the youngest member of this group, who scored on age level on the digit span test of the Illinois Test of Psycholinguistic Abilities.

The results presented in this chapter include a wide range of listener and processing variables. The findings of Experiment 1, Experiment 2, and Experiment 3 will be discussed in Chapter 5. Chapter 5 addresses itself to the implications, the contributions, and the problems related to this research.

Chapter 5

Discussion

The results of these experiments lend support to Hypotheses 1 and 2. The studies demonstrate the significance of considering language comprehension differences. The results also lend support to Hypotheses 3 and 4. The experiments have provided information about the complicated and indirect relationship between memory and comprehension systems. The performances of the learning disabled children have yielded additional information about sentence processing. The results with the LD children reinforced the importance of studying the interaction between a listener's available comprehension strategies with newly-given information as discussed by Haviland and Clark(1975) and Perfetti and Goldman(1975).

Hypotheses 1 and 2 were more specifically related to individual sentence processing. Hypothesis 1 predicted that some LD children would manifest quantitative language differences, i.e., they would not perform as well as the normally achieving children. It also predicted that the LD

children would manifest qualitative language differences, i.e., they would employ different comprehension strategies than the normally achieving children. Hypothesis 2 predicted that a limited number of language comprehension subgroups could be isolated within the LD population. By strategy subgroups was meant that some LD children would make consistent errors on complex sentences. They would show the ability to formulate strategies. Other LD children would make inconsistent errors on complex sentences. They would manifest a general inability to formulate strategies. Hypothesis 2 suggested that these different processing styles would be important.

Hypothesis 3 was related to the effects of prior context upon sentence comprehension. Hypothesis 3 predicted that thematization would affect sentence comprehension. This hypothesis could be confirmed had there been overall facilitation, overall non-facilitation, or differential effects provided by the prior context.

Hypothesis 4 predicted that a relationship would be found between strategy ability and the ability to make use of information from prior contexts.

Support for the Major Hypotheses

Hypothesis 1 is supported mainly by the results of Experiment 1. However, the number (quantitative) and the type (qualitative) of errors made by the normal and the learning disabled children who made errors continued to differentiate the groups of children in Experiment 2. The normally achieving children performed better than the LD children on the two comprehension tasks and on the short-term memory tasks of Experiment 3. The normal group, after nine-and-a-half-years-old, were able to process the complex relative clause sentences. The normally achieving children, who did make errors on the individual sentence processing task in Experiment 1, employed different language comprehension strategies than the LD children. They preferred temporal order strategies, i.e., Assume that the first (or the last) N-V-N sequence is the actor-action-recipient of that sequence. The LD children who made errors showed language comprehension delays, i.e., LD children across all ages were having difficulty processing the relative clause sentences. They also showed language comprehension differences, i.e., LD children tended to use First Noun/Actor and Parallel Function strategies. Many LD children were also inconsistent as well.

Experiment 1 defined the comprehension abilities and the strategy styles of the two groups of children. It outlined the immediate resources, or language tools needed for sentence processing, which were available to the listeners of this particular study. It reinforced the language component in learning disabilities for a large proportion of the LD population. Too, studying the different strategy styles helped to clarify the results which indicated a different hierarchy of difficulty on the four types of sentences for the two groups of children. The LD children showed the ability to act out (with objects) two propositions. It cannot be said, however, that they have an understanding of relativization. This was evidenced by their overuse of N1/Actor strategies with a general tendency to ignore the "that" in their object manipulations. It was also manifested by their overall poorer performances on OO, Os, and So sentences. For instance, the LD performances on the SS relatives such as (113) below may be due to a First Noun/Actor strategy and sentence structure matchup.

(113) SS: The giraffe that kicks the hippo jumps over the bear.

Strategy : Giraffe kicks the hippo/Giraffe jumps over the bear.

The LD children manifested their best performances on the SS relatives. However, they never surpassed the normally achieving children who performed eighty-five per cent correctly on the SS relatives as compared with the seventy-one per cent correct on the SS relatives obtained by the LD children. The normally achieving children manifested their best performances on the object relatives obtaining perfect and near-perfect scores.

Thus, the results of Experiment 1 lend support to Hypothesis 1. The results also indicate that the ages 9;5 to 13;9 may still be language-learning periods for some LD children. This appears to be the case for the four types of sentences studied here. The results on the individual processing task showed that the LD and normal children who made errors did not process information in the same way. The comprehension strategies suggested that the LD children tended to pay attention to individual lexical items in the sentence. This was evidenced by their predominant use of one noun as an actor or a recipient, i.e., the Parallel Function strategy. The normal children, on the other hand, tended to use a more all-encompassing strategy. They attempted to find actor-action-recipient sequences rather than attend to the function of an individual referent.

Hypothesis 2 is supported by the results of all three experiments. Experiment 1 identified two major comprehension strategy subgroups within the LD population. Experiment 2 and Experiment 3 confirmed that these strategy differences were important. Experiment 1 indicated that the LD Strategy Users formed hypotheses about the different sentences. They made errors on the relative clause sentences which showed some organization. The LD Inconsistent children were not able to form consistent hypotheses about the sentences. They switched strategies. They made errors which manifested a general lack of organization. Experiment 2 indicated that the LD Strategy Users also formed consistent hypotheses about the thematized referents. The results showed that the LD Strategy Users were more affected by thematized and non-thematized context differences. This was manifested by their overall improvements on sentences which followed subject thematizations and their general difficulty with sentences which followed object thematizations. The results of Experiment 2, however, also indicated that both the LD Strategy Users and the LD Inconsistent children have some ability to retain information from prior contexts. Most of the learning disabled children were able to pick out the thematized referent. This was evidenced by their

different strategies after thematized and non-thematized contexts. It was also shown by their general use of the thematized referent as a central focus in their object manipulations. Experiment 3 provided some evidence which suggests that the LD strategy Users may have better short-term memory abilities than the LD Inconsistent children. The LD strategy Users performed superiorly to the LD Inconsistent children on both the free recall of words and the memory for digit sequences. The LD Strategy Users performed as well as the normal children on the word list recall task. These data suggest the co-existence of short-term memory variables with comprehension abilities.

Another important point is made. The different LD strategy groups which were defined on a sentence processing task predicted differences in Experiment 2. The two learning disabled groups processed information differently. These comprehension-memory differences may be representative of different cognitive or learning styles.

Hypothesis 3 is also supported by the results of Experiment 2. The results indicate a relationship between given semantic information and sentence comprehension. Specifically, the results showed that sentences were interpreted differently after thematized and non-thematized contexts. The nature of information

remembered from the stories affected immediate comprehension. Thematization acted to bring special attention to one of the characters in each thematized story. Evidence for this came from analysis of the children's comprehension strategies. The thematized referent tended to become an important focus of their object manipulations. As suggested by Perfetti and Goldman(1975), among others, thematization should provide this special focus on one character. However, the results of Experiment 2 also suggested that what is stored in memory may be an interpretation of the theme as a subject. This was evidenced by the predominant tendency among the children to make the thematized referent a subject-actor in the sentences. Thus, thematization appears to provide a listener with more specific information. By more specific information is meant that listeners are more likely to recall a main character as well as make a judgment about its underlying function. The hypothesis that thematization will provide a general facilitating effect upon comprehension was not upheld by these data. Nevertheless, the core of stored information had an effect upon individual sentence processing.

The tendency of the children to make the thematized referent a subject in their comprehension attempts was manifested by errors on all four sentence types. Interpretation of the thematized referent as a subject-

actor is correct in So and OO relatives ((114) and (115) below). The thematized referent(underlined) is a subject-actor in these sentences.

(114) So: The nurse that the doctor pushed bumped into the tennis player.

(115) OO: The Lieutenant found the engineer that the Captain screamed for.

Interpretation of the thematized referent as a subject-actor is incorrect in SS and Os relatives ((116) and (117) below). The thematized referent (underlined) is an object-recipient in these sentences.

(116) SS: The indians that captured the Chief killed the medicine man.

(117) Os: The King touched the Prince that killed the Queen.

The tendency of the children to interpret thematized nouns as subjects helps to clarify the significantly improved performances on So sentences after thematized stories. The thematized referent gives the children specific information about that referent. The listener pays attention to that referent. He also interprets it as a subject in the sentence. The predominant response of the children to interpret thematized nouns as subjects helps to explain the generally poorer performances on SS relatives after thematized stories. The thematized referent gives the children specific, yet less precise,

information. The listener pays attention to the thematized noun. He also interprets it as a subject-actor. Operation of this strategy is evidenced by the significantly poorer performances on SS sentences after thematized contexts. Performances on SS sentences were significantly better after non-thematized contexts.

These results are generally not upheld by the data with both the OO and the Os relatives. OO sentences (115) contained subjects which were thematized. Os sentences (117) contained objects which were thematized. It should follow that comprehension of OO sentences would be facilitated after thematized stories. This is because the thematized referent in OO relatives is the subject in the story and a subject in the sentence. It should also follow that comprehension of Os sentences should not be facilitated by the thematized contexts. This is because the listener gets less precise information. The thematized referent in Os sentences is the subject in the story and an object in the sentence.

The results of Experiment 2 did show that there were more correct responses on OO sentences after thematized stories. However, the differences in scores after thematized and non-thematized stories only approached significance. The performances on the Os sentences after thematized and non-thematized stories remained about the same. Thus, it is unclear as to why

the effect of thematization was a particularly strong one for the subject relatives but not for the object relatives.

The comprehension results obtained in Experiment 1 may provide some information about the asymetrical interaction of thematization and sentence type. It may be useful to consider the general hierarchy of sentence difficulty which was manifested by the children without any prior context. It may also be helpful to reconsider the strategies employed by the children in Experiment 1.

A number of observations can be made when comparing the results of Experiment 2 with the results of Experiment 1. For example, the effect of thematization was greatest on the sentences which represented the best and the poorest performances of the children in Experiment 1. The SS relatives which showed the highest number of correct responses in Experiment 1 showed the lowest number of correct responses after thematized stories in Experiment 2. The So relatives which showed the lowest number of correct responses in Experiment 1 showed a high number of correct responses after thematized stories in Experiment 2. Thus, thematization had a non-facilitating effect upon the best no-context sentences; it

had a facilitating effect upon the poorest no-context sentences. Thematization had a generally nonsignificant effect upon the sentences which fell midway between the two, i.e., the object relatives.

This pattern of performance is better understood by considering the types of errors manifested by the children. The thematization effect is also clarified by comparing the strategies employed by subjects in Experiment 1 and after non-thematized stories. For instance, children tended to make similar errors on So sentences after non-thematized stories and after no-context (Experiment 1). Most of the children had difficulty correctly interpreting N-2, "the doctor"((118) below), as the subject-actor. They tended to interpret "the doctor" as a recipient, i.e., The nurse pushes the doctor and the nurse bumps into the tennis player. The non-thematized story apparently does not

(118) So: The nurse that the doctor pushed bumped into the tennis player.

provide the children with the same information which is provided by the thematized context. The thematized context provides a focus upon "the doctor" as the subject-theme. It also gives the children precise information about the referent they were misinterpreting.

This is partially true for the OO relatives. However,

unlike the So error patterns, the strategies employed on OO sentences in Experiment 1 and after non-thematized stories were not as evenly concentrated on a predominant error. Many of the children did have difficulty correctly interpreting N-3, "the Captain" ((119) below) as a subject-actor in Experiment 1 and after non-thematized stories.

(119) OO: The Lieutenant found the engineer that the Captain screamed for.

They tended to interpret "the Captain" as a recipient, i.e., The Lieutenant found the engineer and the Lieutenant screamed for the Captain. For the children who made this type of error, the thematized context provided the precise information they needed. It provided a focus upon "the Captain" as a subject-theme. Many of the children, however, made different errors on OO sentences in Experiment 1 and after non-thematized stories. For instance, some children had difficulty finding the correct recipient for the final verb. Thus, thematizing "Captain" did not provide this group with the specific information that they required, i.e., "The Captain screamed for the engineer." These children's performances may have shown more significant improvements after thematized stories if "the engineer" had been thematized and if this thematization would have provided them with specific information about

"the engineer" as an object-recipient.

The non-facilitating effect of thematization, i.e., performances of the children being poorer after thematized stories than after non-thematized stories, was also not a uniform one. Significant differences were found between SS sentences which appeared after thematized and non-thematized stories. However, nonsignificant differences were found between Os sentences which appeared after thematized and non-thematized stories. These results are also better understood when viewed in relation to the results of Experiment 1 and the children's performances after non-thematized stories. For example, the predominant tendency of the children to employ a First Noun/Actor strategy was evidenced by considering their performances on SS, So, OO, and Os relatives in Experiment 1. This strategy contributed to many of the correct responses on SS relatives ((120) below). The focus of comprehension on

(120) SS: The indians that captured the Chief killed the medicine man.

one referent as an actor (N-1) is a particularly strong and accurate one. This was one of the major strategies used on SS sentences after non-thematized stories. The non-thematized contexts apparently do little to change this focus upon the first noun. This was evidenced by the

children's object manipulations and their correct responses. On the other hand, the thematized context provided a focus upon "the Chief" as a subject-theme. This served to give the children very precise but inaccurate information. Thematization, at least partially, shifted their attention from N-1, "the indians" to N-2, "the Chief." This was evidenced by the predominant tendency of the children to interpret N2, "the Chief," as a subject-actor, i.e., "The indians captured the Chief and the Chief killed the medicine man." For the most part, however, thematization did not override the use of N-1, "the indians," as the first subject-actor in the sentence.

Unlike the SS relatives, the significant non-facilitation effect of thematization was not manifested with the Os relatives. The children as a whole performed as well on Os sentences after thematized stories as they did on Os sentences after non-thematized stories. Additionally, their performances on the Os relatives were about equal to all the other performances which indicated improvements in Experiment 2. This result is unlike the results of Experiment 1 whereby Os sentences fell midway between the best (SS) and the poorest (So) performances. The performances on Os sentences in Experiment 2 were equal to the best performances on sentences after prior

contexts, i.e., So and OO after thematized stories and SS after non-thematized stories.

In the case of the Os relatives ((121) below) the strategies employed in Experiment 1 and after non-thematized stories did not present as uniform a pattern as those manifested on SS relatives. Likewise, the performances on the Os relatives in Experiment 1 were not as good as those on the SS sentences. This is similar to the comparison made between So and OO relatives regarding thematization facilitation. Some children were employing

(121) Os: The King touched the Prince that killed the Queen.

a similar strategy on Os and SS sentences in Experiment 1 and after non-thematized stories. For example, they tended to interpret N-1, "the King" as the actor of all activities, i.e., The King touched the Prince and the King killed the Queen. For this group, however, thematized contexts provided very specific yet less precise information about one of the referents in the sentence -- the Queen. These children tended to employ different strategies after the thematized stories. They tended to make similar errors on Os sentences as they made on SS sentences after thematized stories. Thematized contexts tended to make them shift strategies. This was evidenced

by the children's use of N-3, the Queen, as a subject-actor, i.e., The King touches the Prince and the Queen kills the Prince. However, some of the children were already using the N-3 (the Experiment 1 counterpart to the "Queen") as an inappropriate subject, i.e., The Queen kills the Prince and the Queen (or the King) touches the Prince. This was evidenced by their object manipulations in Experiment 1. Thus, thematization for Os relatives provided a strategy-structure match-up for some of the children. The thematized referent, the N-3, is already a subject-actor in the children's interpretations. The performances of these subjects tended to be the same after thematized and non-thematized stories. In some cases, then, thematization changed the type of errors made by the children on Os relatives. Thematization did not necessarily change the number of errors made after thematized and non-thematized stories. In other instances, thematization had little effect. The children used the same strategies after thematized and non-thematized stories that they had used in Experiment 1.

The results with the object relatives, both OO and Os sentences, remain the most inconclusive. Nevertheless, it has been shown that the effects of prior context should be viewed in relation to the structure of the sentences used in the on-line comprehension task. Relative clause

sentences may be providing examples of a special case due to their complexity. It has been demonstrated that thematized information is integrated into sentences in a particular way. It was important, however, to consider the effects of thematization in terms of the different comprehension strategies which were available to the children of this study. Their errors on the sentence comprehension task of Experiment 1 and on the non-thematized part of Experiment 2 provided a better understanding of those results with the thematized contexts. However, the sucess or failure for utilizing contextual information will be even better understood when viewed in relation to the different performances of the normal children, the LD Strategy Users, and the LD Inconsistent children.

Hypothesis 4 is also supported by the results of Experiment 2. The importance of the predictions made in Hypothesis 4 is reaffirmed. Indeed, a relationship was indicated between processing style and the ability to use appropriate contextual information. The results of Experiment 2 showed that the LD children performed differently from the normally achieving children. The results also showed that the two LD groups manifested differences between each other.

Experiment 2 suggests an important difference between the normal and these selected LD children. While

the normal and LD children were both able to use contextual cues to help them understand complex sentences, the normal children were also able to dismiss less helpful information. Specifically, the performances of the normal children showed significant improvements on the So relatives after thematized stories when compared with their performances on So relatives after non-thematized stories. They apparently made use of specific thematized information when it was needed, i.e., the thematized referent ((122) underlined) is a subject-actor in the story and in the sentence. Thematization gave the normal

(122) So: The nurse that the doctor pushed bumped into the tennis player.

children the appropriate information to enable them to perform better on the difficult So relatives. However, the normal children neither used this strategy uniformly nor at the expense of real subjects within the sentences. For instance, the normal children did not misinterpret "Chief" as a subject-actor in SS sentences ((123) below) even though "Chief" had been the thematized referent

(123) SS: The indians that captured the Chief killed the medicine man.

in the story. This was evidenced by their equally good performances on SS sentences after thematized and

non-thematized contexts. Likewise, the normal children, replicating their own performances on Experiment 1, also obtained perfect or near-perfect scores on the object relatives in Experiment 2. The results of Experiment 2 with the normal children indicated that they were able to override less precise and less appropriate information provided by some of the thematized stories. Their sentence comprehension was never hurt by the prior contexts.

The learning disabled children as a group had difficulty overriding less appropriate contextual information. Unlike the normal children, the LD Strategy Users and the LD Inconsistent children overused thematized information in immediate sentence comprehension. Both LD groups tended to misinterpret the thematized noun as a subject in SS sentences ((123)). This resulted in significantly poor performances on the SS relatives after thematized contexts. The sentences on which both LD Strategy Users and LD Inconsistent children obtained the highest scores in Experiment 1 became the poorest in Experiment 2 when they appeared after thematized contexts. The non-facilitating effect of thematization was due specifically to the performances of the LD children.

The results of Experiment 2, lending additional support to Hypothesis 4, also showed that the two

learning disabled groups did not make use of contextual information in the same way. Thematization had a greater effect upon the LD Strategy Users than it had upon the LD Inconsistent children. The LD Strategy Users were the most hurt and the most helped by thematization. The results reaffirmed that this group formulated consistent strategies from the given-contextual information. This made it especially difficult for them to dismiss information about the thematized referent in sentence comprehension.

The LD Strategy Users also performed poorly on the Os relatives ((124) below) which appeared after thematized contexts. They were the most consistent in their use of the thematized referent (underlined in (124)) as a subject-actor in the object manipulations. The performances of the LD Inconsistent children on the Os sentences were about

(124) Os: The King touched the Prince that killed <u>the Queen</u>.

Strategy: The King touched the Prince and <u>the Queen</u> killed the Prince.

the same after thematized and non-thematized contexts.

The LD Strategy Users and the normally achieving children were more alike in that thematization had a

strong facilitating effect upon their comprehension of the So relatives ((125) below). This was not the case for the LD Inconsistent children. The LD Inconsistent children performed similarly

(125) So: The nurse that the doctor pushed bumped into the tennis player.

Strategy: The doctor pushed the nurse and the nurse bumped into the tennis player.
(Correct response)

on the So sentences after thematized and non-thematized contexts. Their scores on So relatives were not significantly changed after the different prior contexts. Nevertheless, the qualitative responses of the LD Inconsistent children, i.e., the strategies which were employed on So relatives after thematization, showed a greater degree of organization. They tended to overuse the thematized noun in some way. However, the LD Inconsistent children appeared to have more difficulty integrating the information from prior context into the final sentences than both the normal children and the LD Strategy Users. This was manifested by their strategy of putting the thematized noun aside to watch or to comment. A greater degree of organization was also indicated by their predominant response of overusing the thematized noun as an actor of all activities.

For instance, the LD Inconsistent children more frequently substituted the thematized for N-1. They also used the thematized referent as an inappropriate subject. The LD Strategy Users, on the other hand, tended to maintain N-1 as an actor while using the thematized noun as an inappropriate subject. Sentence (126) below provides an example of the two different strategies.

(126) SS: The indians that captured the Chief killed the medicine man.

LD-Strategy Users : The indians captured the Chief and the Chief killed the medicine man.

LD-Inconsistent: The Chief captured the medicine man and the Chief killed the indians.

The results of Experiment 2 suggest that the LD Strategy Users and the LD Inconsistent children may not differ so much in terms of their ability to abstract the theme of a story. They differ moreso in terms of their ability to integrate particular contextual information into the sentences for comprehension. The results of Experiment 2 also suggest that the normal group may have developed the ability of knowing when to violate strategies. This is an important aspect of language learning as indicated by Bever(1970) and Sheldon(1974).

Considerations For Future Research

The present research attempted to deal with the effects of contextual information upon immediate sentence processing. It reaffirmed the importance of studying the different language comprehension abilities of learning disabled children. It also showed that thematization provides an important organizational effect in story and in sentence processing. However, thematization neither had a uniform effect upon all children nor upon all sentence types.

It has been suggested that what remains more salient in memory from the thematized contexts is the thematized referent and information about its underlying function. This conclusion was based upon the predominant response of the children to interpret the thematized referents as subject-actors in their object manipulations. However, one confounding variable in this research is that all thematized referents were subject-actors in the stories. It remains unclear as to whether all themes would be remembered as subjects. For instance, would the results of Experiment 2 have been the same if the thematized referents had been made object-recipients in the stories? Would thematization per se serve to give a referent special focus in memory?

Would listeners interpret themes as subject-actors regardless of their specific function in the story?

On the other hand, would the results of Experiment 2 have been reversed if all thematized referents had been made object-recipients in the stories? For instance, would performances have been better on the SS relatives ((127) below) after thematized contexts due to the matching of functions in the story and in the sentence. By matching of grammatical-underlying function is meant that the thematized referent (underlined) would have been an object-recipient in the story

(127) SS: The indians that captured the Chief killed the medicine man.

and an object-recipient in the sentence. Likewise, would performances have been poorer on the So relatives ((128) below) after thematized contexts due to the mismatching

(128) So: The nurse that the doctor pushed bumped into the tennis player.

of grammatical-underlying functions, i.e., an object-recipient in the story and a subject-actor (underlined) in the sentence.

Thus, it may not be the case that objects per se make less effective themes than subjects. In this study, the object referents which were thematized were made

subjects in the thematized stories. This was also the case in the Perfetti and Goldman(1975) study. Perfetti and Goldman(1975) reported that object themes were less effective as prompts for the retrieval of active and passive sentences. However, in both cases, the role of the particular referent in thematization should be re-evaluated in terms of its underlying function in the sentence and in the story.

A second confounding variable in this research relates to the thematized referent and the particular sentence type. Subjects were always thematized in relative clauses with violations of canonical order, i.e., the So and the OO relatives. Objects were always thematized in clauses without violations of canonical order, i.e., the SS and the Os relatives. However, it is also the case that the design included one parallel and one non-parallel sentence for each subject-object theme type. Thus, SS relatives with parallel function contained objects which were thematized. OO relatives with parallel function contained subjects which were thematized. Likewise, So relatives without parallel function contained subjects which were thematized. Os relatives without parallel function contained objects which were thematized. It is not unlikely

that violations in canonical order plus referent mismatches, i.e., subject in the story and object in the sentence, would indeed be detrimental to comprehension. OO relatives ((129)below), manifesting violations in canonical order, might have been particularly facilitated if the object (underlined) had been thematized and if it had been made an object-recipient in the story. It remains to be seen as to which changes in research design will provide different

(129) OO: The Lieutenant found <u>the</u> <u>engineer</u> that the Captain screamed for.

results. Indeed, the questions for future research include: What kinds of themes work with which kinds of sentences and on which types of children?

The interaction between short-term memory factors and comprehension processing variables was suggested by the results of Experiment 3. Comprehension and short-term memory problems are viewed as coexisting with one another particularly in the case of the LD Inconsistent children. Indeed, the normally achieving children performed better than both LD groups on the digit span memory task. The LD Strategy Users performed superiorly to the LD Inconsistent children on both the digit span and the free recall tasks of Experiment 3.

It could not be concluded, however, that the

better performances of the normally achieving children and the LD Strategy Users on the free recall of word lists were based upon the ability to formulate and use a clustering strategy, i.e., the spontaneous grouping of words by category. It could not be concluded that the LD Inconsistent children showed limited strategy abilities on the memory task. The results indicated that the number of clusters recalled was not significant. It is believed, however, that these differences may still exist between the two LD groups. The length of the lists used in Experiment 3 were too short. They contained only nine items. The inadequacy of only a zero-to-three span of cluster categories slanted the results.

Tillman(1975) pointed out in her study on clustering in aphasic adults that Miller's(1962) magic number seven can refer to individual items-- or categories. A listener, when overloaded by a list which is too long, might code seven categories in his attempts to recall more items. Thus, it appears that the lists in Experiment 3 should have been longer to instigate a clustering strategy.

The results of Experiment 3 suggest that many of the children may have been employing more simple sequential order memory strategies when given only nine items to

recall. It remains unclear as to why the children who were given a clustered list first performed better than those children who were given a clustered list second. It may be that some inherent organization within the list was abstracted by the group who received the clusterable items first. This may have given them greater confidence for the second list.

Implications for Understanding the Learning Disabled Child

Perhaps the more important and immediate challenge for future research involves further investigation of the two learning disability subgroups. It also remains to study those LD children who obtained perfect or near-perfect scores. Rourke, et. al.(1975) have already begun to isolate some different performance subgroups within the LD population. Many researchers point out that until more organized ways can be developed for discussing the continuum of learning disabilities, little may be accomplished in terms of meeting the educational needs of these special children.

Research involving the study of the relationship between language and learning styles may provide a basis for the development of better assessment and remediation techniques. The results here provide some evidence that the strategies employed by learning disabled children can be changed. The results suggest that the LD Strategy

Users and the LD Inconsistent children may profit from different teaching techniques. For instance, the LD Inconsistent children may have performed better if the paragraphs had been longer. Perhaps five thematized sentences would have helped to initiate more consistent strategies for on-line sentence comprehension. The LD Strategy Users may have to learn more about violating strategies. Perhaps they would have performed better if the paragraphs had been structured differently. It may be the case that filler sentences, i.e., sentences which did not contain the thematized noun but which fit into the context, should have been added to the thematized stories. These neutral sentences may have provided more balance within the stories in that the thematized noun would not have been mentioned three consecutive times.

Additional analysis is also needed to understand the comprehension difficulties of learning disabled children. How are the temporal-order strategy users different from the Parallel Function strategy users? How are the children who split their strategies different from the very confused children? How would younger normally achieving children perform on the same group of tasks?

Cognitive variables should also be considered when attempting to understand the difficulties of learning disabled children. For example, the ability to decenter, i.e., the ability to reflect upon and to compare different aspects of a stimulus, may be another contributing factor in these results. The LD children may not be as capable as the normal children of comparing the information in the sentences with the information in the stories. Indeed, the interplay among conceptual-cognitive, memory, and linguistic variables needs further investigation.

The effects that story organization can have upon comprehension, memory, and learning offers a broad challenge to researchers. The effects of thematization may have implication for reading acquisition and reading disorders. Learning and reading disabled children may benefit from more carefully organized reading materials. Likewise, experimenter definitions of non-thematized contexts may also need re-evaluation. Listeners and readers may spontaneously organize stories in different ways. LD children may have different ideas than normal children about what is important in a non-thematized story. Younger readers may have different discourse strategies from older readers.

The precise nature of the strategies employed by listeners and readers during the comprehension of discourse is an area of current research. Frase(1974) has indicated that a variety of research techniques should be taken. For instance, listeners or readers should be asked questions about stories. Subjects should be stopped at different points when listening to or when reading paragraphs. Frase(1974) also points out that more information regarding differential attention shifts during discourse processing is also needed. Throndyke(1975), Dooling and Lachman(1971), among others, have begun to study story comprehension and memory in greater detail. Perfetti and Goldman(1976) have begun to study discourse memory and reading comprehension skill.

This dissertation has provided another approach to the study of discourse functions as they relate to language and learning disabilities. It has provided a conceptual base for other investigations. The results of these experiments have indicated the importance of studying the interplay between memory and comprehension systems. The information provided by this study represents a contribution toward a better understanding of the difficulties of the learning disabled child.

APPENDIX A

EXPERIMENT ONE *

The Subject Relatives/Subject Focus (SS types)

1. The giraffe that bites the wolf kicks the hippo.
2. The zebra that jumps over the bear pushes the tiger.
3. The alligator that chases the lion hits the elephant.

The Subject Relatives/Object Focus (So types)

1. The wolf that the hippo stands on kisses the zebra.
2. The bear that the tiger hits chases the alligator.
3. The lion that the elephant pushes jumps over the giraffe.

The Filler Coordinates for SS and So types

1. The giraffe kicks the hippo and the giraffe bites the wolf.
2. The wolf stands on the zebra and the wolf kisses the alligator.
3. The wolf kisses the zebra and the hippo stands on the wolf.
4. The hippo bites the bear and the tiger kicks the hippo.

The Object Relatives/Object Focus (OO types)

1. The hippo bites the zebra that the bear jumps over.
2. The tiger chases the alligator that the lion kisses.
3. The elephant kicks the giraffe that the wolf pushes.

The Object Relatives/Subject Focus (Os types)

1. The zebra hits the hippo that stands on the bear.
2. The alligator chases the tiger that bites the lion.
3. The giraffe hits the elephant that jumps over the wolf.

The Filler Coordinates for OO and Os types

1. The hippo bites the zebra and the bear jumps over the zebra.
2. The zebra chases the tiger and the lion kisses the tiger.
3. The zebra hits the hippo and the hippo stands on the bear.
4. The hippo pushes the tiger and the tiger chases the lion.

* Presented randomly

APPENDIX B
EXPERIMENT TWO

GROUP A : Eight Paragraphs and Eight Final Sentences For Comprehension *

*Presented Randomly

Thematized and Non-Thematized Paragraphs Used as Prior Contexts for the SS Relatives

Theme: Object

Thematized
The Lost Papers

Last year, some old books and papers were discovered in an underground cave in California. In some of the papers, the famous Chief Joseph wrote about the daily life, work, and unhappiness of the indian warriors. In the books, this leader told about his special problems with the cruel medicine man, Black Cloud. Finally, in the last chapter of one old book, the Chief wrote about his secret plans to make peace with everyone. But it was too late. (Signal) The indians that captured the Chief killed the medicine man.

Non-Thematized
The Big News Story

Last week, a bank robbery was written about in all the New York City newspapers. Firstly, the robber, James Williams, quietly sneaked into the bank with a gun. Then, Bill Turner, the bank policeman carried the money to the get-away car. Finally, the bank teller, Miss Morgan started the car and then tried to escape into the street. But, it ended in tragedy. (Signal) The policeman that followed the robber shot the bank-teller.

Thematized and Non-Thematized Paragraphs Used a Prior Contexts for the So Relatives

Theme: Subject

Thematized
The Olympic Games

The whole United States team was very excited about going to the Olympics in Innsbruck, Austria. On the plane, Coach John Benson talked to Cindy, the pretty skier about the Olympics, saying: "Just do the best you can. You're part of a great team." Then the coach listened as Bill Harris, the ice skater talked about winning a gold medal. But with all this fun, Coach Benson was still a little sad and a little jealous. And, as it turned out, after the games in Austria, (Signal) The skier that the coached kissed went away with the ice skater.

Non-Thematized
The Baseball Game

All the people at Community Hospital were very happy about their big charity baseball game. In the morning, Dr. James Todd gave out the equipment and told everyone: "This game will help us get money for our great hospital. Then Nurse Judi Bart laughed as everyone came onto the field and started having a good time. The famous tennis player, John Newton was also smiling because playing in the hospital game was such a good cause. And, running the bases, with everyone fooling around, (Signal) The nurse that the doctor pushed bumped into the tennis player.

Thematized and Non-Thematized Paragraphs Used as Prior Contexts for the OO Relatives

Theme: Subject

Thematized
The Navy Ship

Life on the Navy Ship Nautilus is usually very peaceful for the crew. But last week, Captain Jim Harper heard a message on the loud speaker from Lieutenant Johnson: "Water flooding the engine room!" The Captain immediately rang the emergency bell and called Engineer Parker to get help from any nearby ships. Tnen, Captain Harper tried to stop the water and get upstairs. And, in the confusion, (Signal) The Lieutenant found the engineer that the Captain screamed for.

Non-Thematized
The Special Day

Life in the small town of Brewster, New York is usually very quiet. But in 1945, Mayor Bob Willis read the telegram saying: "The Washington train will be stopping in your town on Friday." Sheriff Thompson was very excited because many important people would be stopping in the little town. One of the visitors, General Patton was really happy to get to the station and meet all the people of Brewster, New York. And, on the big day, (Signal) The Sheriff shook hands with the General that the Mayor waved to.

Thematized and Non-Thematized Paragraphs Used as Prior Contexts for the Os Relatives

Theme: Object

Thematized
The Old Paintings

A few years ago, some old paintings were discovered by a group of campers in the English countryside. The powerful Queen Anne drew the paintings, including many of King John of England, on an old castle wall. This famous woman also liked to draw picture-stories about her wars and struggles to beat Prince Geoffrey, another leader. In the pictures, the Queen shows herself fighting many battles to protect all the lands. But, as it really happened in history, (Signal) The King touched the Prince that killed the Queen.

Non-Thematized
The New T.V. Show

A few days ago, a new television series about the Los Angeles fire department was put on Channel 7. In the first show, about a real fire, Peg Jones, a secretary, was working in an office on the top floor. Suddenly, Billy, the young office boy smelled smoke and began to choak --while starting to break down the door. The story ends with a brave fireman running to the stairs and trying to save everyone inside the burning building. And, right before the building collapsed, (Signal) The boy hugged the fireman that carried out the secretary.

APPENDIX C
EXPERIMENT TWO

GROUP B: Eight Paragraphs and Eight Final Sentences For Comprehension *

*Presented Randomly

Thematized and Non-Thematized Paragraphs Used as Prior Contexts for the SS Relatives

Theme: Object

Thematized
The Big News Story

Last week, a bank robbery was written about in all the New York City newspapers. Firstly, the robber, James Williams quietly sneaked by the bank policeman with a gun. Then, this criminal forced Miss Morgan, the bank teller, to carry the money to the getaway car. Finally, the robber started the car and tried to escape down the street. And, it ended in tragedy, (Signal) The policeman that followed the robber shot the bank-teller.

Non-Thematized
The Lost Papers

Last year, some old books and papers were discovered in an underground cave in California. In some of the papers, the famous Chief Joseph wrote about daily life, work, and unhappiness. And, in the books, some of the indian warriors also told about their own special problems. Finally, in the last chapter of one old book, the cruel medicine man, Black Cloud, wrote about his secret plans to make peace with everyone. But, it was to late, (Signal) The indians that captured the Chief killed the medicine man.

Thematized and Non-Thematized Paragraphs Used as Prior Contexts for the So Relatives

Theme: Subject

Thematized
The Baseball Game

All the people at Community Hospital were very happy about their big charity baseball game. In the morning, Dr. James Todd gave all the equipment to Nurse Judi Bart and told everyone: "This game will help us get money for our great hospital." Then the doctor laughed as John Newton, the famous tennis player, came onto the field and started having a good time. Dr. Todd kept smiling all day because playing in the hospital game was such a good cause. And, running the bases, with everyone fooling around, (Signal) The nurse that the doctor pushed bumped into the tennis player.

Non-Thematized
The Olympic Games

The whole United States team was very excited about going to the Olympics in Innsbruck, Austria. On the plane, Coach John Benson talked about the Olympics saying: "Just do the best you can. You're a great team!" Then Cindy Nelson, the pretty skier, talked about winning a gold medal. But with all this fun, Bill Harris, the great ice skater, was still a little sad and a little jealous. But, as it turned out, after the games in Austria, (Signal), The skier that the coach kissed went away with the ice skater.

Thematized and Non-Thematized Paragraphs Used as Prior Contexts for the OO Relatives

Theme: Subject

Thematized
The Special Day

Life in the small town of Brewster, New York is usually very quiet. But in 1945, Major Bob Willis read the telegram from Sheriff Thompson saying: "The Washington train will be stopping in your town on Friday." The Mayor was very excited because many important people, including General Patton, would be stopping in the little town. Waiting for all the visitors, the Mayor was really happy to get to the station to meet all the people from Washington, D.C. And, on the big day, (Signal) The Sheriff shook hands with the General that the Mayor waved to.

Non-Thematized
The Navy Ship

Life on the Navy Ship Nautilus is usually very peaceful for the crew. But last week, Captain Jim Harper heard a message on the loud speaker: "Water flooding the engine room!" Lieutenant Johnson immediately rang the emergency bell and called to get help from any nearby ships. Then Engineer Parker tried to stop the water and get upstairs. And, in the confusion, (Signal) The Lieutenant found the engineer that the Captain screamed for.

Thematized and Non-Thematized Paragraphs Used as Prior Contexts for the Os Relatives

Theme: Object

Thematized
The New T.V. Show

A few days ago, a new television series about the Los Angeles fire department was put on Channel 7. In the first show, about a real fire, Peg Jones, a secretary was wroking with Billy, the office boy in a room on the top floor. Suddenly, Peg smelled smoke and began to choak as a fireman was starting to break down the door. The story ends with the secretary running to the stairs and trying to escape from the burning building. And, right before the building collapsed, (Signal) The boy hugged the fireman that carried out the secretary.

Non-Thematized
The Old Paintings

A few years ago, some old paintings were discovered by a group of campers in the English countryside. The powerful Queen Anne drew the paintings on an old castle wall. The famous King John of England is in some of the picture stories about the wars and the struggles of all the leaders. In another group of pictures, Prince Geoffrey is the one fighting many battles to protect all the lands. And, as it really happened in history, (Signal) The King touched the Prince that killed the Queen.

APPENDIX D
EXPERIMENT THREE

CLUSTERED AND NON-CLUSTERED LISTS*

Group I Clustered List A	Group II Non-Clustered List A'
arm	arm
head	rose
hand	bird
dog	dog
cat	nurse
cow	flag
car	car
plane	rope
truck	ladder

Group II Clustered List B	Group I Non-Clustered List B'
leg	leg
foot	baby
eye	top
horse	horse
bear	glass
lion	potato
train	train
boat	hill
wagon	bell

*Presented Randomly Counterbalanced for Group List and Order of Presentation

BIBLIOGRAPHY

Abrams, K., and Bever, T.G. "Syntactic Structure Modifies Attention During Speech Perception and Recognition." Quarterly Journal of Experimental Psychology, 21, 1969, 280-90.

Amidon, A., and Carey, P. "Why Five-Year-Olds Cannot Understand 'Before' and 'After'." Journal of Verbal Learning and Verbal Behavior, 11, 1972, 417-33.

Baird, R., and Koslick, J. "Recall of Grammatical Relations within Clause-Containing Sentences." Journal of Psycholinguistic Research, 3, 1974, 165-71.

Barclay, J.R. "Comprehension and Sentence Memory." Cognitive Psychology, 4, 1973, 229-54.

Bateman, B. "An Educator's View of a Diagnostic Approach to Learning Disorders." Learning Disorders. Edited by J. Hellmuth. Seattle: Special Child Publications, 1965.

Beilin, H. Studies in the Cognitive Basis of Language Development. New York: Academic Press, 1975.

Berry, M.F. Language Disorders of Children: The Bases and Diagnoses. New York: Appleton-Century-Crofts, 1969.

Bever, T.G. "A Survey of Some Recent Work in Psycholinguistics." Specification and Utilization of a Transformational Grammar. Edited by W.J. Plath. New York: Thomas J. Watson Research Center, International Business Machines Co., 1968.

Bever, T.G. "The Cognitive Bases of Linguistic Structures." Cognition and the Development of Language. Edited by J.R. Hayes. New York: Wiley, 1970.

Bever, T.G.; Lackner, J.R.; and Kirk, R. "The Underlying Structures of Sentences are the Primary Units of Immediate Speech Processing." Perception and Psychophysics, 5, 1969, 225-31.

Bever, T.G., and Mehler, J. "The Coding Hypothesis and Short-term Memory." Af Technical Report. Cambridge, Mass.: Harvard Center for Cognitive Studies, 1967.

Blaubergs, M.S., and Braine, M.D. "Short-term Memory Limitations on Decoding Self-embedded Sentences." Journal of Experimental Psychology, 102, 1974, 745-48.

Blumenthal, A.L. "Prompted Recall of Sentences." Journal of Verbal Learning and Verbal Behavior, 6, 1967, 203-6.

Blumenthal, A.L., and Boakes, R. "Prompted Recall of Sentences: A Further Study." Journal of Verbal Learning and Verbal Behavior, 6, 1967,674-6.

Bousfield, W.A. "The Occurrence of Clustering in the Recall of Randomly Arranged Associates." Journal of Genetic Psychology, 47, 1953, 818-21.

Bransford, J.; Barclay, J.; and Franks, J. "Sentence Memory: A Constructive Versus Interpretive Approach." Cognitive Psychology, 3, 1972, 193-209.

Bransford, J., and Franks, J. "The Abstraction of Linguistic Ideas." Cognitive Psychology, 2, 1971 331-50.

Bransford, J., and Johnson, M. "Considerations of Problems of Comprehension." Visual Information Processing. Edited by W. Chase. New York: Academic Press, 1973.

Bransford, J., and McCarrell, N. "A Sketch of a Cognitive Approach to Comprehension; Some Thoughts About What It Means to Comprehend." Cognition and Symbolic Processes. Edited by W.B. Weimer and D.S. Palermo. Potomac, MD.: Erlbaum Associates, 1975.

Brown, A.L. "Semantic Integration in Children's Reconstruction of Narrative Sequences." Cognitive Psychology, 8, 1976, 247-62.

Brown, H.D. "Children's Comprehension of Relativized English Sentences." Child Development, 42, 1971, 1923-36.

Cairns, H.S., and Blank, M. "Word Recognition Latency and the Duration of Clausal Processing." Unpublished Manuscript, Queens College of the City University of New York, 1975.

Cairns, H.S., and Cairns, C.E. Psycholinguistics: A Cognitive View of Language. New York: Holt, Rinehart, and Winston, 1976.

Caplan, D. "Clause Boundaries and Recognition Latencies for Words in Sentences." Perception and Psychophysics, 12, 1972, 73-6.

Carpenter, P.A. "On the Comprehension, Storage, and Retrieval of Comparative Sentences." Journal of Verbal Learning and Verbal Behavior, 13, 1974, 401-11.

Carroll, J.B. "Defining Language Comprehension: Some Speculations." Language Comprehension and the Acquisition of Knowledge. Edited by J.B. Carroll and R.O. Freedle. New York: Wiley, 1972.

Chomsky, C. The Acquisition of Syntax in Children from Five to ten. Cambridge, Mass.: MIT Press, 1969.

Chomsky, N. "Current Issues in Linguistic Theory." The Structure of Language. Edited by J.A. Fodor and J.J. Katz. Englewood Cliffs, N.J.: Prentice Hall, 1964.

Chomsky, N. Aspects of the Theory of Syntax. Cambridge, Mass.: MIT Press, 1967.

Chomsky, N. Language and Mind. New York: Harcourt, Brace, and World, 1968.

Clark, H.H. "The Prediction of Recall Patterns in Simple Active Sentences." Journal of Verbal Learning and Verbal Behavior, 5, 1966, 99-106.

Clark, H.H., and Clark, E.V. "Semantic Distinctions and Memory for Complex Sentences." Quarterly Journal of Experimental Psychology, 20, 1968, 129-39.

Coleman, E.B. "Learning of Prose Written in Four Grammatical Transformations." Journal of Applied Psychology, 49, 1965, 332-49.

Cook, V.A. "Strategies in the Comprehension of Relative Clauses." Language and Speech, 18, 1975, 204-12.

Cromer, R. "'Children are nice to Understand': Surface Structure Clues for the Recovery of a Deep Structure." British Journal of Psychology, 61, 1970, 397-408.

Davis, J., and Blasdell,R. "Perceptual Strategies Employed by Normal Hearing and Hearing-Impaired Children in the Comprehension of Sentences Containing Relative Clauses." Journal of Speech and Hearing Research, 18, 1975, 281-94.

de Hirsch, K. "Specific Dyslexia or Strephosymbiolia." Folia Phoniatrica, 4, 1952, 231-48.

Denchla, M. "Clinical Syndromes in Learning Disabilities: The Case for Splitting and Lumping." Journal of Learning Disabilities, 5, 1972, 401-6.

Doehring, D.G. Patterns of Impairment in Specific Reading Disability. Bloomington: Indiana University Press, 1968.

Dooling, D., and Lachman, R. "Effects of Comprehension on Retention of Prose." Journal of Experimental Psychology, 88, 1971, 216-22.

Dooling, D., and Mullet, R. "Locus of Thematic Effects in Retention of Prose." Journal of Experimental Psychology, 97, 1973, 404-6.

Eisenson, J. Aphasia in Children. New York: Harper and Row, 1972.

Ervin-Tripp, S. "Discourse Agreement: How Children Answer Questions." Cognition and the Development of Language. Edited by J.R. Hayes. New York: John Wiley, 1970.

Fodor, J.A. "Current Approaches to Syntax Recognition." The Perception of Language. Edited by D. Horton and J. Jenkins. Columbus, Ohio: Charles E. Merrill, 1971.

Fodor, J.A., and Bever, T.G. "The Psychological Reality of Linguistic Segments." Journal of Verbal Learning and Verbal Behavior, 4, 1965, 414-20.

Fodor, J.A., and Garrett, M. "Some Determinants of Sentential Complexity." Perception and Psychophysics, 2, 1967, 289-96.

Fodor, J.A.; Garrett, M.; and Bever, T.G. "Some Syntactic Determinants of Sentential Complexity II: Verb Structure." Perception and Psychophysics, 3, 1968, 453-61.

Forster, K.I., and Olbrei, I. "Semantic Heuristics and Syntactic Analysis." Cognition, 2, 1973, 319-47.

Frase, L. "Maintenance and Control in the Acquisition of Knowledge from Written Materials." Language Comprehension and the Acquisition of Knowledge. Edited by J.B. Carroll and R.O. Freedle. New York: John Wiley, 1972.

Frostig, M., and Horne, D. The Frostig Program for the Development of Visual Perception. Chicago: Follett Publishing Company, 1964.

Fygetakis, L.J., and Ingram, D. "Language Rehabilitation and Programmed Conditioning: A Case Study." Journal of Learning Disabilities, 6, 1973, 60-4.

Garrett, M.; Bever, T.; and Fodor, J. "The Active Use of Grammar in Speech Perception." Perception and Psychophysics, 1, 1966, 30-2.

Getman, G. "The Visuomotor Complex in the Acquisition of Learning Skills." Learning Disorders. Edited by J. Hellmuth. Seattle: Special Child Publications, 1965.

Goldsmith, S.C.; Wallach, G.P.; and Beilin, H. "Variables in Processing Time Sentences: Linguistic and Cognitive Considerations." Paper Presented at the Northeastern Modern Language Association Convention, Penn State University, April, 1974.

Gough, P. "One Second of Reading." Language by Ear and by Eye. Edited by J. Kavanagh and I. Mattingly. Cambridge, Mass.: MIT Press, 1972.

Guthrie, J.T.; Goldberg, H.K.; and Finucci, J. "Independence of Abilities in Disabled Readers." Journal of Reading Behavior, 4, 1972, 129-38.

Hakes, D. "Effects of Reducing Complement Constructions on Sentence Comprehension." Journal of Verbal Learning and Verbal Behavior, 11, 1972, 278-86.

Hakes, D., and Cairns, H.S. "Sentence Comprehension and Relative Pronouns." Perception and Psychophysics, 8, 1970, 5-8.

Hakes, D.; Evans, J.; and Brannon, L. "Understanding Sentences with Relative Clauses." Memory and Cognition, 4, 1976, 283-90.

Hakes, D., and Foss, D. "Decision Processes During Sentence Comprehension: Effects of Surface Structure Reconsidered." Perception and Psychophysics, 8, 1970, 413-16.

Hallahan, D., and Cruichshank, W. M. Psychoeducational Foundations of Learning Disabilities. Englewood Cliffs, New Jersey: Prentice Hall, 1973.

Halliday, M.K. "Notes on Transitivity and Theme in English." Journal of Linguistics, 3, 1967, 199-244.

Halliday, M.K. "Clause Types and Structural Function." New Horizons in Linguistics. Edited by J. Lyons. Penguin Books, 1970.

Hammill, D. "Training of Visual Perceptual Processes." Journal of Learning Disabilities, 5, 1972, 39-44.

Harris, R.J. "Memory and Comprehension of Implications and Inferences of Complex Sentences." Journal of Verbal Learning and Verbal Behavior, 13, 1974, 626-37.

Harris, R.J. "Children's Comprehension of Complex Sentences." Journal of Experimental Child Psychology, 19, 1975, 420-33.

Haviland, S., and Clark, H. "What's New? Acquiring New Information as a Process in Comprehension." Journal of Verbal Learning and Verbal Behavior, 13, 1974, 512-21.

Horowitz, L., and Prytulak, L. "Redintegrative Memory." Psychological Review, 76, 1969, 519-531.

Humboldt, W. von. Uber die Verschiedenheit des Menschlichen Sprachbaues. Berlin. Facsimile edition, Bonn, 1960.

Huttenlocher, J.; Eisenberg, K.; and Strauss, S. "Relation between Perceived Actor and Logical Subject." Journal of Verbal Learning and Verbal Behavior, 7, 1968, 527-30.

Huttenlocher, J., and Strauss, S. "Comprehension and a Statement's Relation to the Situation It Describes." Journal of Verbal Learning and Verbal Behavior, 7, 1968, 300-4.

Huttenlocher, J., and Weiner, S. "Comprehension of Instructions in Varying Contexts." Cognitive Psychology, 2, 1971, 369-85.

James, C.T. "Theme and Imagery in the Recall of Active and Passive Sentences." Journal of Verbal Learning and Verbal Behavior, 11, 1972, 205-11.

James, C.T.; Thompson, J.G.; and Baldwin, J.M. "The Reconstructive Process in Sentence Memory." Journal of Verbal Learning and Verbal Behavior, 12, 1973, 51-6.

Jarvella, R. "Syntactic Processing of Connected Speech." Journal of Verbal Learning and Verbal Behavior, 10, 1971, 409-16.

Johnson, D., and Myklebust, H. Learning Disabilities: Educational Principles and Practices. New York: Grune and Stratton, 1967.

Johnson, M.K.; Bransford, J.D.; and Solomon, S. "Memory for Tacit Implications of Sentences." Journal of Experimental Psychology, 98, 1973, 203-5.

Just, M.A., and Carpenter, P.A. "The Relation between Comprehension and Remembering Some Complex Sentences." Memory and Cognition, 4, 1976, 318-22.

Kagan, J.; Moss, A.; and Siegel, I.E. "Psychological Significance of Styles of Conceptualization." Basic Cognitive Processes in Children. Volume 28. Edited by J.C. Writh and J. Kagan. Monographs of the Society for Research in Child Development, 1963.

Kephart, N. The Slow Learner in the Classroom. Columbus, Ohio: Charles E. Merrill, 1960.

Kimball, J. "Seven Principles of Surface Structure Parsing in Natural Language." Cognition, 2, 1973, 15-48.

Kirk, S.A., and Kirk, W.D. Psycholinguistic Learning Disabilities: Diagnosis and Remediation. Urbana: University of Illinois Press, 1971.

Klein-Konigsberg, E. "Semantic Integration in Normal and Learning Disabled Children." Unpublished Ph.D. Dissertation, The Graduate School and University Center of City University of New York, 1977.

Koppitz, E.M. Children with Learning Disabilities: A Five Year Follow-Up Study. New York: Grune and Stratton, 1971.

Lachman, R., and Dooling, D. "Connected Discourse and Random Strings: Effects of the Number of Inputs on Recognition and Recall." Journal of Experimental Psychology, 77, 1968, 517-22.

Lahey, M. "Use of Prosody and Syntactic Markers in Children's Comprehension of Spoken Sentences." Journal of Speech and Hearing Research, 17, 1974, 656-68.

Larson, S.C.; Rogers, D.; and Sowell, V. "The Use of Selected Perceptual Tests in Differentiating between Normal and Learning Disabled Children." Journal of Learning Disabilities, 9, 1976, 32-9.

Levelt, W.J., and Kempen, G. "Semantic and Syntactic Aspects of Remembering Sentences: A Review of Some Recent Continental Research." Studies in Long-Term Memory. Edited by A. Kennedy and A. Wilkes. New York: John Wiley, 1974.

Liberman, A.; Cooper, F.; Shankweiler, D.; and Studdert-Kennedy, M. "Perception of the Speech Code." Psychological Review, 74, 1967, 431-61.

McNeill, D. The Acquisition of Language. New York: Harper and Row, 1970.

Miller, G. "Some Psychological Studies of Grammar." American Psychologist, 17, 1962, 748-62.

Miller, G., and Isard, S. "Free Recall of Embedded English Sentences." Information Control, 7, 1964, 292-303.

Monroe, M. Children Who Cannot Read. Chicago: University of Chicago Press, 1932.

Moore, T.M. "Speeded Recognition of Ungrammaticality." Journal of Verbal Learning and Verbal Behavior, 11, 1972, 550-60.

Neisser, U. Cognitive Psychology. New York: Appleton-Century-Crofts, 1967.

Paivio, A. "Imagery and Language." Imagery: Current Cognitive Approaches. New York: Academic Press, 1971.

Paris, S.G., and Lindauer, B.K. "The Role of Inferences in Children's Comprehension and Memory for Sentences." Cognitive Psychology, 8, 1976, 217-27.

Perfetti, C.A., and Goldman, S.R. "Thematization and Sentence Retrieval." Journal of Verbal Learning and Verbal Behavior, 13, 1974, 70-9.

Perfetti, C.A., and Goldman, S.R. "Discourse Functions of Thematization and Topicalization." Journal of Psycholinguistic Research, 4, 1975, 257-71.

Perfetti, C.A., and Goldman, S.R. "Discourse Memory and Reading Comprehension Skill." Journal of Verbal Learning and Verbal Behavior, 14, 1976, 32-42.

Pompi, K., and Lachman, R. "Surrogate Processes in the Short-Term Retention of Connected Discourse." Journal of Experimental Psychology, 75, 1967, 143-50.

Rees, N.S. "Auditory Processing Factors in Language Disorders: The View from Procrustes' Bed." Journal of Speech and Hearing Disorders, 38, 1973, 304-15.

Reitan, R.M. "Psychological Effects of Cerebral Lesions in Children of Early School Age." Clinical Neuropsychology: Current Status and and Applications. Edited by R.M. Reitan and L.A. Davison. Washington, D.C.: Winston, 1974.

Robinson, H. Why Pupils Fail in Reading. Chicago: University of Chicago Press, 1952.

Rohrman, N.L. "The Role of Syntactic Structure in the Recall of English Nominalizations." Journal of Verbal Learning and Verbal Behavior, 7, 1968, 904-12.

Rourke, B.P. "Brain-behavior Relations in Children with Learning Disabilities." American Psychologist, 30, 1975, 911-20.

Rourke, B.P., and Czudner, G. "Age Differences in Auditory Reaction Time of 'Brain Damaged' and Normal Children Under Regular and Irregular Preparatory Interval Conditions." Journal of Experimental Child Psychology, 14, 1972, 372-78.

Rourke, B.P.; Dietrich, D.M.; and Young, G.C. "Significance of WISC Verbal-Performance Discrepancies for Younger Children with Learning Disabilities." Perceptual and Motor Skills, 36, 1973, 275-82.

Rourke, B.P.; Yanni, D.W.; MacDonald, G.W.; and Young, G.C. "Neuropsychological Significance of Lateralized Deficits on the Grooved Pegboard Test for Older Children with Learning Disabilities." Journal of Consulting and Clinical Psychology, 41, 1973, 128-34.

Sachs, J.S. "Recognition in Memory for Syntactic and Semantic Aspects of Connected Discourse." Perception and Psychophysics, 2, 1967, 437-42.

Semel, E., and Wiig, E. "Comprehension of Syntactic Structures and Critical Verbal Elements by Children with Learning Disabilities." Journal of Learning Disabilities, 8, 1975, 53-9.

Sheldon, A. "The Role of Parallel Function in the Acquisition of Relative Clauses in English." Journal of Verbal Learning and Verbal Behavior, 13, 1974, 272-81.

Silliman, E. "The Comprehension and Use of Projective Semantic Relations During Middle Childhood and Pre-Adolescence: Implications for the Acquisition of Spoken and Written Language. Unpublished Ph.D. Dissertation, The Graduate School and University Center of City University of New York, 1976.

Slobin, D.I. "Grammatical Transformations and Sentence Comprehension in Childhood and Adulthood." Journal of Verbal Learning and Verbal Behavior, 5, 1966, 219-27.

Slobin, D.I. "Developmental Psycholinguistics." A Survey of Linguistic Science. Edited by W. O. Dingwall. Linguistics Program: University of Maryland.

Smith, P., and Marx, R. "Some Cautions on the Use of the Frostig Test." Journal of Learning Disabilities, 5, 1972, 42-7.

Stark, J.A. "Comparison of Performance of Aphasic Children on Three Sequencing Tasks." Journal of Communicative Disorders, 1, 1967, 31-4.

Stark, J.A. "Reading Failure: A Language-Based Problem." ASHA, 17, 1975, 832-34.

Stein, N., and Prindaville, P.S. "Discrimination Learning and Stimulus Generalization by Impulsive and Reflective Children." Journal of Experimental Child Psychology, 21, 1976, 25-39.

Stick, S.L., and Norris, J.A. "Understanding of Embedded Sentences by Normal and Language and Learning Disordered Children." Paper Presented at the American Speech and Hearing Association Convention, Washington, D.c., November, 1975.

Strauss, A., and Lehtinen, L. Psychopathology and Education of the Brain-Injured Child. New York: Grune and Stratton, 1947.

Strauss, A., and Werner, H. "Deficiency in the Finger Schema in Relation to Arithmetic." American Journal of Orthopsychiatry, 8, 1938, 719-25.

Strauss, A., and Werner, H. "Disorders of Conceptual Thinking in the Brain-Injured Child." Journal of Nervous and Mental Disease, 96, 1942, 153-72.

Studdert-Kennedy, M. "The Perception of Speech." Current Trends in Linguistics. Volume XII. Edited by T.A. Sebeok. The Hague: Mouton, 1974.

Sulin, R., and Dooling, D. "Intrusion of a Thematic Idea in Retention and Prose." Journal of Experimental Psychology, 103, 1974, 255-62.

Tenney, Y.J. "The Child's Conception of Organization and Recall." Journal of Experimental Child Psychology, 19, 1975, 100-14.

Thorndyke, P.W. "Cognitive Structures in Human Story Comprehension and Memory." Unpublished Ph.D. Dissertation, Stanford University, 1975.

Thorndyke, P.W. "The Role of Inferences in Discourse Comprehension." Journal of Verbal Learning and Verbal Behavior, 15, 1976, 437-66.

Tillman, D. "Clustering by Aphasics in Free Recall." Unpublished Ph.D. Dissertation, The Graduate School and University Center of the City University of New York, 1975.

Valtin, R. "Report of Research on Dyslexia in Children." Paper Presented at the International Reading Association Convention, Denver, 1973.

Vaughn, M. "Clustering, Age, and Incidental Learning." Journal of Experimental Child Psychology, 6, 1968, 323-34.

Walker, E. "Grammatical Relations in Sentence Memory." Unpublished Ph.D. Dissertation, Indiana University, 1969.

Wallach, G.P., and Goldsmith, S.C. "Sentence Comprehension Strategies in the Learning Disabled Child: A Look at Auditory-Verbal and Visual-Verbal Channels." Paper Presented at the American Speech and Hearing Association Convention, Washington, D,C., November, 1975.

Wanner, E. On Remembering, Forgetting, and Understanding Sentences. The Hague: Mouton, 1974.

Wanner, E., and Maratos, M. "On Understanding Relative Clauses." Unpublished Manuscript, Harvard University, 1971.

Weiner-Mayster, L. "Language Comprehension Strategies of Children Who are Learning Disabled." Paper Presented at the American Speech and Hearing Association Convention, Washington, D.C., November, 1975.

Wepman, J. "Auditory Discrimination, Speech, and Reading." Elementary School Journal, 1960, 325-33.

Wiig, E., and Semel, E. "Comprehension of Linguistic Concepts Requiring Logical Operations by Learning Disabled Children." Journal of Speech and Hearing Research, 16, 1973, 627-36.

Wiig, E., and Semel, E. "Logico-Grammatical Sentence Comprehension by Adolescents with Learning Disabilities." Perceptual and Motor Skills, 38, 1974, 1331-34.

Wiig, E., and Semel, E. "Productive Language Abilities in Learning Disabled Adolescents." Journal of Learning Disabilities, 8, 1975.

Wiig, E.; Semel, E.; and Crouse, M. "The Use of English Morphology by High-Risk and Learning Disabled Children." Journal of Learning Disabilities, 6, 457-64.

Winston, M.E. "Comprehension of Relative Clause Sentences in Children." Unpublished Masters Thesis, University of Illinois at Urbana-Champaign, 1972.

Witkin, B.R. "Auditory Perception: Implications for Language Development." Language, Speech, and Hearing Services in Schools, 2, 1971, 31-52.

Zach, L., and Kaufman, J. "How Adequate is the Term 'Perceptual Deficit' for Education." Journal of Learning Disabilities, 5, 1972, 36-42.