ROTH, FROMA P.

EFFECTS OF INTERVENTION ON RELATIVE CLAUSE SENTENCE PROCESSING IN YOUNG NORMAL CHILDREN

City University of New York PH.D. 1980

EFFECTS OF INTERVENTION ON RELATIVE CLAUSE SENTENCE PROCESSING IN YOUNG NORMAL CHILDREN

by

FROMA P. ROTH

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.

1979

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

1/14/80
date

Chairman of Examining Committee

1/16/80
date

Executive Officer

Dr. Joel Stark

Dr. Norma S. Rees

Dr. William O. Dingwall
Supervisory Committee

The City University of New York

Abstract

EFFECTS OF INTERVENTION
ON RELATIVE CLAUSE PROCESSING
IN YOUNG NORMAL CHILDREN

by

Froma P. Roth

Adviser: Professor Helen S. Cairns

In order to determine whether direct intervention can accelerate normal children's language comprehension abilities, 18 children, ranging in age from 3 1/2 to 4 1/2 years, participated in this three phase research project. The Pretest Phase served as a screening procedure for the selection of subjects. The Intervention Phase consisted of three tra..ning sessions for each of three training conditions: the Explicit Training Condition (Condition I), the Implicit Training Condition (Condition II), and the Control Condition (Condition III). The Posttest Phase was designed to test learning of the target sentence structures.

The linguistic stimuli consisted of four types of relative clause sentences. The sentences used in the Pretest and Posttest Phases were different from those used in the Intervention Phase. The children's task in each phase was to enact the sentence by manipulating toy objects.

The training procedures were developed to indirectly test the predictions of Slobin's (1973) putative universal that rearrangement of word order and interruption of related clausal constituents result in increased sentence processing complexity for young children. Subjects in Condition I were taught noninterrupted versions of the relative clause sentences. The training procedure for subjects in Condition II was designed to rely solely on the children's natural inductive capacities for acquiring language. These children heard the relative clause sentences only in their surface form. The subjects in Condition III served as controls and received training on two-clause conjoined sentences.

The two major hypotheses tested in this study were that (1) young children can be trained to understand relative clause sentences at an accelerated rate and (2) that Explicit Training (Condition I) would be a more effective intervention procedure than Implicit Training (Condition II).

The results of this study clearly demonstrated that direct intervention was effective in teaching children to understand relative clause sentences. The solid improvement in the performance of the subjects in the two experimental training conditions on the relative clause sentences between the Pre-and Posttest Phases contrasted significantly with the lack of improvement demonstrated by subjects in the control condition, confirming the first major hypothesis of this study. However, the degree of improvement demonstrated on the relative clause sentences was similar for subjects in

Conditions I and II, disconfirming the second hypothesis.

In addition, subject relative sentences with subject focus and object relative sentences with subject focus were found to be the easiest to comprehend, while subject relatives with object focus caused children the greatest difficulty. This order of difficulty among the sentence types was consistent for all three Conditions and across the Pretest-Posttest Phases of the experiment.

Qualitative analysis of each enactment error was also completed. The most salient finding was that the First Noun strategy accounted for the majority of errors, providing support for the canonical-sentoid hypothesis described in the literature.

ACKNOWLEDGEMENTS

Transcending all phases of this dissertation research is the realization that I am an extremely fortunate person. The source of this fortune lies on my associations with a variety of skillful and sensitive individuals whose support and expertise were instrumental not only to the successful closure of my doctoral study but also to my personal growth.

The form of surrealism which defines my doctoral thesis experiences was tempered by the realism and wisdom of each member of my advisory committee. My sincere gratitude to:

...Dr. Helen S. Cairns, who introduced me to and inspired my interest in the fields of linguistics and psycholinguistics. During my doctoral study, Professor Cairns readily shared her seemingly infinite resevoir of knowledge as well as her contagious enthusiasm for scholarly and meaningful research. Her intelligent and insightful guidance have made our association an extremely memorable one for me.

...Dr. Normal S. Rees, whose theoretical and clinical perspective of childhood language disorders has continually guided my thinking about the implications of the normal language acquisition process for the communicatively disordered population. Dean Rees' innovative input and encouragement have been a tremendous resource thoughout my professional training.

...Dr. Joel Stark deserves a thunderous ovation and endless curtain calls for his indefatiguable confidence in this study and in me. His thorough commitment, wise counsel,

and positive attitude during every step of this project helped me continue when completion seemed impossible. To this man of paramount integrity and enormous sensitivity, I remain forever grateful.

In addition to the members of my advisory committee, my deepest gratitude is extended to others whose contributions were invaluable to the completion of my doctoral work:

...Ms. Evelyn Pollack, who planted the seeds of my clinical philosophy.

...Mr. Robert Rosenbaum, who nurtured those seeds with a most unique combination of skill, expertise, gentility of spirit, and a sixth sense about human nature. It has been an honor to know and learn from this man.

...Susan Wurtzel and Antonia Maxon, who shared both the joys and frustrations of my graduate study.

...Paulette Henson, who typed this manuscript to perfection and Carole Weiner, who typed the tables.

...Dr. Sue Ellen Krause, dear friend and colleague, who spent countless hours, days, and nights reading, rereading, and editing my manuscript, continually providing me with insightful criticism and a wealth of superb suggestions. Her boundless energy, inner strength, and perserverence were most poignantly laced with a wonderful sense of humor. My appreciation and respect for Dr. Krause extend far beyond my facility with the English language.

...Edward Roth, husband, friend, and my most devoted advocate in life, who endured this labor for a number of

years, never losing vision of the light at the end of the tunnel. His uncanny linguistic intuitions and explicit knowledge of the rules underlying relative clause sentences were truly a gift when sifting through the myriad of error data. This man's unwavering belief in me helped me believe in myself.

A special note of thanks goes to my parents, Hattie and Irving Pearl, whose faith in me never faltered. Their complete support and continuous encouragement are acknowledged with love.

Therein lies my fortune!

TABLE OF CONTENTS

Chapter Page

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

The Problem

A major area of research in developmental psycholinguistics has involved the specification of comprehension strategies and linguistic processing skills used by children to understand and produce incoming sentences. Bever (1970), Ervin-Tripp (1970), Slobin (1970), Chomsky (1969), Cromer (1971), Amidon and Carey (1972) and Sheldon (1974), among many other investigators, have studied the development of comprehension strategies in children. These researchers outlined developmental progressions in children from the use of basic canonical order strategies, to clausal strategies, to lexical strategies, up through the use of more complete and subtle methods of sentence analysis.

With a reexamination of the competence-performance distinction undertaken in the past two decades, investigators 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).

For the most part, adult listeners analyze and comprehend messages quickly and relatively effortlessly. Proficient language users have competency-based strategies for chunking incoming strings. Their knowledge of linguistic rules enables them to use both grammar and strategies to understand sentences. For young children acquiring language, who do not have a complete knowledge of the grammar, comprehension may be much more difficult. Some of their comprehension strategies, unlike those employed by adults, are non-competency based and draw upon a variety of cognitive, social, and linguistic skills.

In the broader view, language learning, although innate, does not occur in a vacuum, but proceeds within the general context of the child's overall developing cognitive and social systems (Piaget, 1952; Bruner, 1975; Schlesinger, 1977; etc.). The interplay between general cognitive development and language learning has been the focus of several accounts of the language acquisition process (Bloom, 1974, 1978; Bowerman, 1973; Brown, 1973; Schlesinger, 1977; Slobin, 1971, 1973; Beilin, 1975; Sinclair-de-Zwart, 1973; Kagan 1979; Bloom and Lahey, 1978, etc). Slobin (1973) stated that conceptual development is the pacesetter for linguistic development, and more pointedly, that linguistic growth proceeds within the constraints of a universal course of cognitive growth. By inference then, the rate and sequence of comprehension strategy acquisition and the later

internalization of linguistic rules is controlled by pre-determined maturational factors. It is not clear, however, to what extent the innate language learning mechanism is constrained by more global maturational factors. In other words, one might ask whether the development of linguistic abilities is tightly constrained by the development of the brain as is the ability to walk or whether the innate language learning mechanism is more flexible and somewhat less subject to "developmental destiny".

In an attempt to explore further the interaction between language and cognitive development, an important theoretical question emerges: is it possible to exploit the child's innate ability to learn language through direct intervention, and trigger hypothesis-forming mechanisms to facilitate the comprehension of syntactic structures at an accelerated rate? It is this question that the present research has been designed to examine.

The remainder of this introductory Chapter will address certain aspects of the language acquisition process and the relationship between competence and performance during this period. The importance of comprehension strategies is the focus of the latter issue. Subsequent sections will describe a theory of language acquisition (Slobin, 1973) and relate its theoretical principles to developmental use of comprehension strategies in children. A discussion of sentence processing will be provided in light of three major hypotheses that attempt to account for how listeners

understand sentences. Finally, the focus and theoretical implications of the present research, motivated by an integration of the subject matter in the previous sections, will be considered.

The Language Acquisition Process

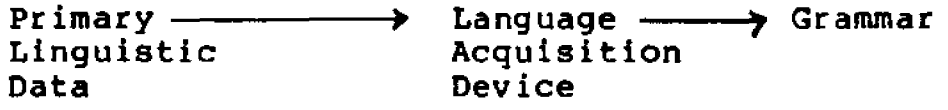
To learn the structure of language, a child must acquire two things: an internalized knowledge of the rules which describe well-formed sentences in his language (linguistic competence) and a set of psychological skills necessary to allow him to produce and comprehend sentences in his native language (linguistic performance).[1] Human infants are born with an innate predisposition to develop language with certain universal properties according to a universal developmental pattern. In this view, language acquisition is seen as an active and constructive process. The child formulates a series of rule systems (grammars) to describe the regularities underlying the speech he hears in his environment. These grammars result from inductions from the linguistic code from the speech the child hears around him. His initial grammars are primitive, but adequate. Gradually, as the child progresses in cognitive development, he develops

---

[1]The inadequacy of traditional behaviorist theories to account for the language acquisition process has been repeatedly demonstrated in the developmental psycholinguistic literature (Lenneberg, 1967; Bellugi and Klima, 1966; McNeill, 1966, 1970; Brown, 1968, 1973; Bever, 1970; Brown, Cazden, and Bellugi, 1969; Slobin, 1971; Menyuk, 1971; E. Clark, 1973; etc.).

an increasing need to convey more complex, differentiated, and conceptually rich messages. He hears more samples of speech and his grammar is reorganized and refined. The grammars become increasingly more sophisticated, until eventually, by adulthood or earlier, the child integrates the knowledge he has acquired into the adult grammar (Bever, 1970). At this point, the development of linguistic competence has been essentially completed.

This theory is traditionally represented in the following way:



The primary linguistic data (PLD) can be defined as the speech that the child hears in his environment during the language learning years. The Language Acquisition Device (LAD) is considered to be the language learning mechanism and is the innate property of the child. It is presumed to contain the language universals. The LAD constructs syntactic rules (grammar) based on the limited corpus experienced by the child.

The Relationship between Competence and Performance during the Language Acquisition Process

As originally postulated by Chomsky (1965), the concepts of linguistic competence and linguistic performance have discrete boundaries and have a one-way relationship. Based on his description, the performance skills of an adult speaker are dependent upon competence. The language-production system

and the language-comprehension system access the linguistic knowledge represented by the grammar. However, when one studies how the child acquires his native language, the boundary between competence and performance becomes far less definitive. In fact, there seems to be a unique interdependence between these two systems during the language learning years.

As the child develops linguistic competence, he develops linguistic performance skills which permit him to generate meaningful utterances in his language and to interpret the utterances of others, so that he can attain some degree of understanding. Clearly, a child must be able to figure out the meaning of sentences before he can begin to develop the linguistic competence for assigning complete structural analyses to them (Bever, 1970). In other words, the child must have some way of identifying meaning independently of the formal rule system before he can develop the formal rule system for pairing sound and meaning. Thus, the ability to understand (and produce) sentences must precede the development of a complete formal system of linguistic knowledge.

During the language acquisition years, then, the child develops performance skills in addition to formal grammatical knowledge (linguistic competence). The development of linguistic performance skills is the development of comprehension and production strategies (C. Chomsky, 1969; Bever, 1970; Cromer, 1970; Ervin-Tripp, 1970; E. Clark, 1970,

1971, 1974; Ferreiro and Sinclair, 1971; deVilliers and deVillers, 1973, 1978; R. Clark, 1974; McLean and Snyder, 1978). These strategies are formulated by children, based on their knowledge of the world. As such, early strategies are concrete, behavioral short-cuts that children develop and use to understand (and produce) sentences in lieu of formal linguistic knowledge. Consider the following two sentences:

(1-1) The pony was ridden by the girl.

(1-2) The boy was chased by the girl.

The three year old child who accurately interprets a passive sentence such as (1-1), but inaccurately interprets a sentence such as (1-2), which is also in the passive voice, cannot be credited with full linguistic competence for the passive transformational rule. Rather, the child uses a pragmatic comprehension strategy, a performance skill, to interpret these kinds of sentences. The child is relying on his knowledge of the world and knows that horses do not ride girls, so that there is only one set of plausible grammatical relations that would result in a coherent interpretation of (1-1).

There is also evidence that children develop strategies which are based solely upon nonlinguistic contextual cues. In a study that examined comprehension of the locative terms <u>in</u>, <u>on</u>, and <u>under</u>, for instance, E. Clark (1974) found that very young children relied on salient perceptual attributes to understand the three experimental locative expressions. From the performance data obtained, Clark posited the existence of

two strategies (which she termed "rules") used by her subjects between the ages of 1 year, 6 months, and 2 years, 5 months for interpreting utterances containing these locatives. The consistency of the children's errors indicated that they used an ordered series of comprehension strategies that instructed them to interpret sentences containing in, on, and under in a particular way.

As exemplified by the above studies, children frequently misinterpret sentences that violate their strategies, suggesting that during the language acquisition process, children are heavily reliant on comprehension strategies as a means for deciphering the linguistic code.

However, once the child is developing strategies for understanding (and producing) a particular type of sentence, he develops other kinds of strategies for figuring out the grammatical rule(s) that his language uses for expressing concepts or relationships linguistically. These other strategies are known as language acquisition strategies and are qualitatively different from early comprehension and production strategies. The language acquisition strategies allow the child to learn the grammar of his language, bit by bit, and result in the development of internalized linguistic rules or linguistic competence.

When the child has induced one linguistic rule, he can then use that rule for several purposes; that is, the child employs his developing linguistic competence in the actual production and comprehension of sentences and for acquisition

of other grammatical rules of his language. Since language learning is a dynamic process, the rules are constantly being revised, new rules are acquired, and new comprehension strategies are being formulated. Each new development affects the form of the child's linguistic system, and in this way, the whole language learning process becomes a "mutually dependent" and constantly changing system. In other words, the child uses his performance skills to develop linguistic competence. However, in the process, he employs his existing linguistic knowledge to refine his performance skills so that he can acquire additional "bits" (grammatical rules) of linguistic competence. Thus, there seems to be a trading relationship between competence and performance during the language acquisition process. Based on the data that have been accumulated on the language acquisition process then, it seems that a sensible framework for viewing the development of language in children includes at least four overlapping but sequential activities: (1) the development of concepts; (2) the development of strategies for understanding and producing sentences prior to the acquisition of the complete grammar of the language; (3) the gradual development of strategies for figuring out the grammar of the language; and (4) the development of internalized linguistic rules (Cairns and Cairns, 1976, p. 222).

In summary, it appears that children do not employ grammatical rules in comprehension during the earliest stages

of language learning. Instead, comprehension of sentences, based on grammatical rules, improves only as children's linguistic knowledge increases.

Slobin's (1973) Theory of Language Acquisition

Recent theoretical approaches to language acquisition attempt to provide a detailed explanation of the language learning process by examining the interaction between general cognitive development and language development (Bloom, 1974; Bowerman, 1973; Brown, 1973; Bloom and Lahey, 1978). The most viable such theories view cognitive growth as prerequisite to and as the pacesetter of linguistic growth.

One such integrative approach was proposed by Slobin (1973). In accordance with Piaget (1952), he posited a universal and invariant sequence of cognitive development through which all human children proceed in the acquisition of conceptual knowledge. Based on an extensive examination of available child language data, Slobin specified in some detail how the facts of language learning can be accounted for as occurring within the constraints of cognitive acquisitions. Essentially, he argued that language is used only to express what the child already knows. Accordingly, it is the conceptual knowledge that provides the basis of early language learning. Slobin captured the interaction between cognitive growth and linguistic development in the following principle: "New forms first express old functions and new functions are first expressed by old forms" (p. 184).

The developmental psycholinguistic literature provides numerous examples in support of this principle. Brown (1973), for instance, has noted that in the normal language acquisition process, children frequently acquire new forms to express the same function that the child already understood and expressed in a less complex form. Brown's analysis of the emergence of English inflections of three children revealed that the first inflections to emerge marked just those functions already implicit in verb use at the previous stage of development when all verbs were unmarked. Cromer's (1968) study of the development of temporal expressions in English illustrate the second half of Slobin's principle. Cromer found that shortly before the acquisition of the perfect tense, his subjects attached now and yet to statements referring to a past action, producing utterances which performed the same function as the perfect tense. For instance, " I didn't make the bed yet" was precursor to the perfect form, "I haven't made the bed." This example clearly demonstrates that the child has acquired a concept for which a new grammatical device must be discovered.

Based on Slobin's principle, Cairns and Cairns (1976) postulated three stages in the acquisition of a grammatical device for encoding a particular concept. During the first stage, the child does not possess the concept and does not express it linguistically. During the second stage, the child develops a new concept; that is, the child acquires the ability to conceive of something in his environment and he

wants to talk about it. However, he does not possess the grammatical device to encode this concept linguistically, so his linguistic productions do not reflect the acquisition of the newly-acquired concept. At this point, the child uses the old form to express the new function, but he may use his old linguistic form in a more specialized manner. It is at this stage that the child searches for a new means to express the new concept linguistically. The child, during the third stage, discovers the grammatical device to encode his new concept, and his verbalizations reflect this new acquisition.

Slobin (1973) did not postulate a universal sequence of language development, but recall his statement that linguistic growth proceeds within the constraints of a universal course of linguistic growth. According to Slobin's theory, some grammatical devices are easier to learn than others because they comport with the child's earlier hypotheses. The earlier the hypothesis matches the device, the earlier the grammatical device will be acquired. In other words, the relative difficulty of learning a specific grammatical form is largely dependent upon the way in which a particular language encodes a concept linguistically. For example, Slobin reported that a child who was bilingual in Serbo-Croatian and Hungarian produced locative forms in Hungarian before producing the same forms in Serbo-Croatian. Since the spontaneous and consistent appearance of locative forms in Hungarian evidenced that the child acquired the concept of locative relationships, it is plausible to

hypothesize that the differential language performance is a result of structural differences between the Serbo-Croatian and Hungarian. In fact, an analysis of these two languages reveals that in Hungarian, locatives take the form of suffixes roughly analogous to "doll drawer-in", whereas in Serbo-Croatian, locatives are prepositions roughly analogous to "doll in drawer". In other words, these two languages use different grammatical devices to encode the same concept, and it appears that suffixes are easier to learn than pre-verbal prepositions.

Based on such evidence from a variety of languages, including English, Slobin (1973) proposed a set of operating principles, or universal principles of language acquisition, that assist the child in discovering the grammatical devices of his language; these operating principles are the language acquisition strategies described in the previous section. In other words, the set of operating principles represent a theory of the hypotheses that children make unconsciously and use to learn linguistic rules. Slobin refers to the operating principles as "self-instructions for language acquisition." For example, Operating Principle D states: "Avoid interruption and rearrangement of linguistic units" (p. 352). This operating principle claims that children seek to preserve the underlying structure of linguistic units in their surface manifestations. While this principle is a hypothesis about language learning, it is reasonable to assume that a sentence with an interruption or rearrangement

of linguistic units will be more difficult to process than a sentence that does not contain an interruption or rearrangement.

The Relationship between Operating Principles and Comprehension Strategies

Unlike the early comprehension strategies that the child develops and uses to figure out the meanings of sentences, the operating principles make no specific predictions about comprehension, per se. Presumably, once the child has developed a strategy which allows him to understand (and produce) a particular type of sentence, he can then attend to and formulate hypotheses about the grammatical device that his language uses for the linguistic expression of that particular concept. However, there may be an interaction between comprehension strategies and operating principles; the relative ease of developing a grammar of a language may be directly related to the ease of comprehension of particular sentence types in that language. As Bever (1970) stated,

> the child will learn the grammar for those sentences which he can understand (at least partially). Conversely, the child will have difficulty in learning the putative grammatical structure underlying sentences that he has difficulty understanding (p 312).

If such a relationship exists, one can make predictions about the types of grammatical structures that are easier for the

child to learn and, perhaps, about their order of acquisition, based on the relative ease of comprehension.

To demonstrate this proposed interaction between comprehension strategies and operating principles, consider the following two sentences:

(1-3) He came to the party/that I gave.

(1-4) The man/who fell down/ran away.

In contrast to (1-3), (1-4) contains an interruption. Based on Operating Principle D, one would predict that the grammatical device for encoding sentences that contain an interruption such as (1-4), would be acquired at a later point in language development than sentences such as (1-3) which do not contain an interruption. In terms of sentence processing, the child may formulate strategies for interpreting sentences such as (1-3) before he can understand sentences sush as (1-4), because processing complexity may increase as a function of the amount of separation between related parts of a sentence. Thus, the greater the separation between related constituents, the greater is the processing difficulty, which in turn may result in the relatively late acquisition of the grammatical device for encoding interrupted sentences.

Language Comprehension and Sentence Processing

The hypothesis that the relative ease of acquiring grammatical devices may be directly related to the ease of comprehension seems plausible in light of the findings reported in the psycholinguistic literature. Research in sentence

comprehension reveals that there is differential comprehension difficulty associated with different grammatical forms.

In general terms, to comprehend a sentence, a listener must decode the sentence to recover, among other things, the basic grammatical relations. According to the comprehension literature, it appears that the more a superficial structure of a sentence distorts the basic grammatical relations, the more complex the comprehension process becomes (Fodor and Garrett, 1967).

To understand how listeners comprehend sentences, it is of value to consider three competing hypotheses: (1) the Canonical-Sentoid Hypothesis; (2) the Interruption Hypothesis; and (3) The Parallel Function Hypothesis. Each hypothesis attempts to explain how distortion of the basic grammatical relationships affect the ease with which a sentence can be processed. The following three sections provide a brief introduction to these hypotheses, each of which will be discussed more extensively in Chapter II.

1. Canonical-Sentoid Hypothesis

The canonical-sentoid hypothesis developed by Bever (1970) attempts to account for effects of word order on sentence comprehension. Canonical order refers to the most common order of constituents as they appear in clauses in the language. The canonical order of a clause in English consists of a subject NP and a V which may or may not be followed by an object, and can be represented as NP-V-(NP) (Fodor, Bever, and Garrett, 1974).

This hypothesis proposes a general strategy of sentence interpretation based on the canonical order of constituents in any given language. The initial hypothesis of the comprehension system will be that NP-V-(NP) corresponds to S-V-O. This hypothesis assumes that in English, the perceptual complexity of a sentence is increased if the surface order of the elements differs from the canonical sentence order (i.e. the order in the underlying structure, in which the first NP is the subject and the second NP is the object of a sentoid) (Fodor and Garrett, 1967; Fodor, 1971). The active sentence is an example of a sentence type in which the canonical order is preserved in the surface structure, as in (1-5):

(1-5) The boy pushes the girl.
(subject) (verb) (object)

On the other hand, the passive construction is an example of a sentence type in which the surface constituent order departs from the canonical order of English sentences as in (1-6):

(1-6) The girl is pushed by the boy.
(object) (verb) (subject)

In the passive construction, the constituents in the surface structure are reversed, and the underlying object or recipient of "action" is moved to the initial position of the sentence. The canonical-sentoid hypothesis thus predicts that passive sentences are more difficult to process than their active counterparts and than all object initial

sentences, because such sentences violate canonical word order.

2. Interruption Hypothesis

The interruption hypothesis proposes that listeners have more difficulty dealing with a sentence whose related parts are interrupted than with a sentence which contains no interruptions (Miller and Isard, 1964; Chomsky, 1965; Slobin, 1973). The interruption hypothesis (Miller, 1962) predicts that self-embedded (SE) sentences are more difficult to understand than sentences with comparable semantic complexity but of a different structure, such as right branching (RB) sentences. In an SE sentence, the embedded clause interrupts the subject-verb sequence of the matrix sentence. That is, the embedded clause is interposed between the subject NP and the verb of the main clause, interrupting the usual sequence of those related linguistic units. On the other hand, in an RB sentence, the object NP of the main clause is modified by the subordinate clause; the subordinate clause is not embedded within the matrix sentence, but follows it. It has been hypothesized that interruption of a NP (subject)-VP-NP Object string by another string, makes it difficult to integrate the NP subject of the first string with its appropriate VP (Miller and Isard, 1964, Chomsky, 1965; Baird, 1973).

Presumably, the difficulty lies in holding the early part of the sentence in short-term memory (STM) until its related part is heard (Fodor, Bever, and Garrett, 1974). It is

assumed that the sentence-decoding processes utilize some of the listener's available STM. One of the sentence-processing functions is the retention of incompletely analyzed portions of the input sentence while the processing mechanisms operate on the remainder of the sentence. It is also believed that these operating mechanisms themselves use some of the available STM during comprehension. Thus, sentences which contain interruptions such as SE constructions increase processing difficulty, as they require the listener to hold unanalyzed material in STM. Therefore, such constructions impose more of a burden on STM than do noninterrupted sequences.

3. Parallel Function Hypothesis

The parallel function hypothesis is a third major hypothesis that attempts to account for differential comprehension difficulty associated with different grammatical forms. Sheldon (1974) was interested in a particular complex sentence type, namely, sentences containing relative clauses. Such sentence types represent one common way that two or more English sentences can be combined to form a complex sentence. Relative clauses may occur in different positions within a sentence; they may modify the subject NP or the object NP of the sentence and are known as subject relatives and object relatives, respectively. As shown in sentence (1-7) below, subject relatives are sentences in which the relativized NP (who) is

the subject of the relative clause; object relatives are sentences where the relativized NP (who) is the object of the relative clause as in (1-8).

(1-7) The girl/who kissed John/was blushing.

(1-8) The girl kissed John/ who the dog licked.

Sheldon drew a further distinction between sentences containing relative clauses, contrasting parallel function to nonparallel function sentences. A parallel function sentence is one in which the relativized NP in the relative clause has the identical grammatical function in the embedded sentence as the modified NP has in the matrix sentence. A nonparallel function sentence is one in which the relativized NP has a different grammatical function in the embedded sentence than does the modified NP in the matrix sentence. Sentences (1-9) and (1-10) are examples of parallel function sentences; sentences (1-11) and (1-12) illustrate nonparallel function sentence types. Notice that (1-9) and (1-11) are subject relatives while (1-10) and (1-12) are object relatives.

(1-9) The dog/that jumps over the pig/bumps into the lion.

(1-10) The dog stands on the horse/that the giraffe jumps over.

(1-11) The dog stands on the horse/that bumps into the lion.

(1-12) The dog/that the horse bumps into/jumps over the giraffe.

Examination of the parallel function sentence types reveals,

for example, that the relative pronoun that in (1-9) is the relativized NP which represents a deep structure NP the dog. That functions as the subject of the embedded clause. Likewise, the NP the dog in (1-9) is the subject of the matrix sentence. In (1-10), that functions as the object of the relative clause and the head noun the horse is an object in the matrix sentence. In other words, in (1-9) and (1-10), the co-referential NP's share the same grammatical function in their respective clauses (either as subjects or objects).

In (1-11), a nonparallel function sentence, the relative pronoun that is the subject of the embedded sentence, while the head NP the horse is the object of the matrix sentence. In (1-12), that is the object of the embedded sentence. The head NP the dog, however, is the subject of the matrix sentence. In (1-11) and (1-12), then, the co-referential NP's have different grammatical functions in their respective clauses.

The parallel function hypothesis proposes that processing is easier for relative clause sentences whose co-referential NP's have the same grammatical function in their respective clauses (i.e. both are subject or both are object), than for sentences whose co-referential NP's have different grammatical functions. Thus, it is predicted that a parallel function sentence is easier to process than a nonparallel function sentence, presumably because listeners employ the "parallel function strategy" and assume that the relativized pronoun has the same grammatical function as its antecedent

NP. It should be noted that Bever's (1970) "double function" hypothesis is analogous to Sheldon's postulation. Essentially, it states that sentences in which the grammatical function of the NP's is different in their respective clauses will be more difficult to understand than those in which the relativized NP has the same function as its antecedent NP.

To summarize, a definition has been provided for the competing hypotheses under consideration, each of which predicts that sentence structure affects sentence processing and comprehension for both children and adults in different ways and to varying degrees. Literature related to each of these hypotheses will be discussed in length in Chapter II.

Summary

This Chapter has provided an overview of the language acquisition process, demonstrating a relationship between cognitive development and language development. In general, within that relationship, conceptual development seems to precede language development. Slobin (1973) has further posited that children have innate operating principles for acquiring the rules of their native language, although these principles do not make specific predictions about comprehension, per se. In addition, both adults and children have been shown to employ comprehension strategies to process sentences; adults' strategies are competency-based, while young children's are not. It is apparent that certain

structures present less processing difficulty than others for adults, and that certain structures are acquired by children at earlier points in development than are other forms. Three competing hypotheses which attempt to account for differential sentence processing difficulty were presented. The degree of constraint that cognitive development has on language acquisition remains an unresolved issue. Moreover, little is known about the factors which may engage the language learning mechanism to operate at a "precocious rate." Still another issue is that a relationship between children's comprehension strategies and operating principles has not been demonstrated, although it seems plausible and of interest. If such a relationship does exist, one could make predictions regarding the relative ease and order of sentence type acquisition.

This material has been summarized to motivate the present investigation. It is of value at this point to delineate the focus and theoretical implications of the proposed research.

Focus of the Proposed Research

As stated in the Problem section, the present research is concerned with exploring whether it is possible to accelerate the child's innate ability to develop comprehension strategies for understanding a particular linguistic form at an earlier point in development than the form would naturally be acquired. One way to obtain such information is to select a linguistic structure, here the singly embedded relative clause construction, and to teach it in a systematic fashion at a

point before the child is developmentally destined to acquire it. Through a controlled intervention procedure, this study sought to document the effects of such training on children's ability to learn relative clause structures. The study also sought to identify the heuristic strategies employed by the children in their attempts to understand these linguistic forms. The present study was conducted with a normal population, although clinical implications of this work will be discussed in Chapter V.

Theoretical Implications of the Proposed Research

Slobin's (1973) account of language learning introduced earlier in this Chapter can serve as a basis for highlighting the theoretical implications of this study. While his theory acknowledges the intrinsic linguistic capabilities of the human mind, Slobin proceeds to account for these capabilities with hypotheses about general characteristics of human cognitive development and general principles by which children organize linguistic input. These principles are proposed to operate within the context of overall conceptual development. By inference then, Slobin's theoretical paradigm supports the notion that language acquisition is intimately related to all forms of maturational human intelligence. The extent to which the innate language learning mechanism is bound by maturational factors is the major issue at hand. If linguistic abilities are as completely constrained by the development of the brain as is the ability to walk, then

training of linguistic structures still beyond a child's developmental grasp would be fruitless. (Later, we will examine studies that attempted to teach children a variety of cognitive tasks prior to the acknowledged readiness period and show that to a large extent, integrated learning did not occur.) However, it can be hypothesized that linguistic knowledge is a unique form of human cognition, and as such, may be more amenable to acceleration. Attempting to teach a structure currently beyond a child's control may be a means of examining maturational constraints on language learning and may yield information that can help delineate the parameters of the innate language learning mechanism.

CHAPTER II

REVIEW OF RELATED LITERATURE

While information regarding the acceleration of linguistic abilities in normal children is sparse, there is a wealth of literature describing the nature of linguistic input to the language learning child. Both bodies of literature will be reviewed here. This Chapter will also address studies which attempted to teach normally-developing children a variety of non-linguistically based cognitive tasks prior to their natural period of acquisition. Relevant literature dealing with language comprehension abilities and with strategies for sentence processing in both adults and children will be discussed.

Primary Linguistic Data and Intervention

The primary linguistic data available to the language-learning child has been the subject of many investigations (Brown and Bellugi, 1964; Brown, 1973; Phillips, 1973; Shipley, Smith, and Gleitman, 1969; Broen, 1972; Snow, 1974, 1976; Sachs, 1977; Newport, Gleitman, and Gleitman, 1977; Gleason, 1977; and Ferguson, 1977). The majority of information concerning "motherese" or "baby talk" has evolved from observations of parent-child interactions. This

methodology has resulted in the identification of certain common processes that operate in parent-child dyads. Imitation, expansion, discourse-modeling and constituent-prompting are among the processes proposed that may affect language acquisition.

Observations have also revealed that adults typically modify their speech when addressing young children (Snow, 1972, 1974; Phillips, 1973; Sachs, 1977; Garnica, 1977; Broen, 1972). Adult utterances tend to be short (i.e. smaller MLU) and contain simple syntactic constructions, a greater degree of redundancy, a high proportion of questions (Toler and Bankson, 1976; Sachs, Brown and Salerno, 1972), imperative forms, and a noted lack of hesitation phenomena. Even children as young as four years old produce many of these same modifications when speaking to younger children (Sachs and Devin, 1976; Shatz and Gelman, 1973). Recent evidence has also shown that adults (Cramblit and Siegel, 1977) and normal preschool children (Guralnick and Paul-Brown, 1978; Stoel-Gammons and Coggins, 1977; Gallagher and Darnton, 1977) adjust their communication styles to language impaired and mentally retarded children. This is not to suggest that a causal relationship exists between the verbal environment of the young child and his natural acquisition of language; however, it seems likely that these adjustments facilitate the child's ability to master a complex linguistic system with relative speed and ease.

The information gained from an observational methodology

is useful in identifying the characteristics of primary linguistic data and raises speculation on their function in the language acquisition process. However, such a methodology is insufficient to determine the effects of input variables on linguistic development or whether any of these adjustments are necessary to the child's construction of a linguistic system. A controlled intervention study may clarify some of the uncertainties inherent in naturalistic observation paradigms.

To describe more precisely the effects of motherese on language development, it is at least necessary to control the linguistic input to the child and analyze the child's responses. This approach was used by Cazden (1965) who pursued the effect of expansion and modeling as training devices. In an expansion, the adult repeated a child's telegraphic utterance and supplied the elements that rendered it into the nearest properly formed complete sentence as in (2-1). The adult's expansion preserved the word order and meaning intended by the child. A model was a well-formed sample of adult speech that functioned as a comment on the content of the child's utterance as can be seen in (2-2).

(2-1) Child: Dog eat bone.
Adult: Yes, the dog is eating the bone.

(2-2) Child: Dog bark.
Adult: Yes, but he won't bite you.

Cazden's premise was that since primary linguistic data form the data base from which children develop hypotheses,

isolation of specific features of input should produce observable differences in the rate and quality of a child's linguistic development. Cazden's subjects, 12 black children, aged 28-38 months, were randomly assigned to one of three treatment groups: expansion, modeling, or control. The expansion group received 40 minutes per day of intensive and deliberate expansions. The modeling group received exposure to an equal number of well-formed sentences that were not expansions. Children in the control group received no treatment, but they were brought into the testing rooms every few days to remain familiar with the materials and the tutors. Cazden's results showed that modeling was the most effective treatment condition as measured by six indices of language development, which included mean length of utterance, complexity of syntactic structure, and vocabulary. Moreover, there was no evidence that expansions aided the acquisition of grammar in her subjects.

These results suggested that the semantic support provided by modeling may be more crucial to the induction of rules than expansions, which only highlighted the structural properties of the adult linguistic system. Although the role of expansion and modeling in facilitating the acquisition of grammatical rules remains an unsolved issue (Brown, and Bellugi, 1964; McNeill, 1970; Feldman and Rodgon, 1970; Sachs, 1977; Snow, 1972, 1974; Ferguson, 1977), Cazden's study represents the first attempt to manipulate adult linguistic input systematically in order to discover the

manner of operation of the Language Acquisition Device and to clarify the nature of the antecedent events that engage this innate mechanism.

Intervention Studies Examining the Relationship between Cognitive Development and Language Development

There have been numerous training experiments reported in the cognition literature which have sought to clarify the interplay between language and intellectual development. The studies that will be discussed in this section are confined to two types: (1) those which attempted to accelerate the child's acquisition of cognitive operations necessary for conservation through verbal- and nonverbal mediated tasks and (2) those which explored the child's ability to learn linguistic rules without previously demonstrating the conceptual abilities which are assumed to underly their meaningful use. As will be shown, the results of these investigations have led to conflicting interpretations.

1. The Nature of Conservation

A major focus of these investigations has been on the study of conservation, as it appears to offer some important possibilities for understanding the general character of cognition, cognitive development, and its relationship to the language acquisition process. As a starting point, conservation may be said to involve the ability to retain one of a series of physical concepts in the face of transformation

of elements related to that concept. The psychological principles of conservation ensure the permanence of real objects across changes in their appearance. In effect, these principles enable conservation of objects in reality by permitting one to distinguish between the real and apparent both in thought and reality. Piaget (1952), Piaget and Inhelder (1941) and others have shown clearly that until the age of about six or seven years, children believe that quantities do change under transformations.

The question of how conservation is attained is a particularly fascinating one in light of the present study. It is difficult to see how experience alone could possibly provide a basis for acquiring conservation, or how conservation could be developed without a basis of experience.

The inadequacy of direct observation as a basis for conservation is not due just to the presence of some misleading perceptual cues that need to be overcome, though such cues are clearly often present. In many cases there simply are not any criteria perceptually available that would permit accurate comparisons. The criteria that are normally available become removed by the transformation. For example, when one is asked to compare the amount of water in two identical glasses, in a liquid quantity conservation task, the relation between the heights reached by the water in the two glasses provide a clear perceptual cue for comparison. But no such cue is available when the water from one of these glasses has been poured into a glass of different proportions

from the first, so that the water to be compared is in containers of different shapes (Elkind, 1967). Whether the amounts in dissimilar containers are the same or not, an individual's senses do not suffice to tell him so. Similarly, area conservation requires maintenance of the concept (i.e. area remains invariant) while a related attribute, the physical pattern, is transformed, although the total area remains the same.

For some kinds of conservation, however, there certainly are external criteria upon which comparisons can be made after the relevant transformations have been performed. For example, the number of a set of objects may be ascertained by counting that there are still the same number of items in a row after the items have been stretched out. Likewise, the weight of objects can be compared by weighing them on a scale before and after the relevant transformations.

2. Conservation Experiments - Verbal- and Nonverbal-Mediated Tasks

Experiments on counting conducted by Wohlwill and Lowe (1962) did not affect conservation in their subjects. These authors attempted to specify the nature of the processes at work in the development of the notion of conservation of number. They reasoned that although Piaget (1952) had described some of the precursors of conservation of number in children, little was known about the specific ways in which the transition from lack of conservation to the presence of

conservation takes place. Further, they suggested that an adequate explanation of this problem ultimately requires a clearer understanding of the psychological processes at work in this transition stage. Wohlwill and Lowe hypothesized that one approach to this problem is to expose children, presumed to be slightly below the age of onset of conservation, to selected systematically manipulated learning experiments. These experiments were designed to call into play different factors believed to be important in the development of number conservation.

The investigation was in the form of a nonverbal match-to-sample type learning experiment. Pretest and Posttest nonverbal and verbal conservation tasks[1] were conducted to measure the child's understanding of the conservation principle. There were four conditions of training, involving the role of: reinforced practice on

---

[1]The nonverbal conservation series consisted of three two-phase trials. The experimenter (E) instructed the subject(S) to count a set of stars (in order to find a chip behind the "correct window"). Following S's initial response, S was told to return the chip to E, who replaced it behind the same window, and then, depending on the trial, either shortened or lengthened the row of stars. S was allowed to count the stars only in the first phase of the trial; he thus had to find the correct window in the second phase on the basis of knowledge gained in the first, in face of the perceptual changes in the rows of stars.

The verbal conservation series was as follows: two rows of seven chips each, one blue and the other red, were placed parallel to each other so that both rows were of the same length and the chips in one row were directly opposite those in the other. S was asked "Who has more chips, you or I?" Following S's response, E extended the red row in both directions to a length about twice that of the blue row and repeated the question.

conservation (RP); of inferential mechanisms based on the recognition of effects of addition and subtraction of elements (A+S); and of dissociation of biasing perceptual cues (Diss.). A control condition was also included.[2]

The subjects were 72 kindergarten aged children (35 boys and 37 girls) with a mean chronological age of 5 years, 10 months. Eighteen subjects, closely matched in chronological age, were assigned to each of four conditions of training.

In each condition, the subjects were seated in front of an upright panel containing three windows which had the numerals 6, 7, and 8 inscribed on them from left to right. Subjects were presented with a row of colored stars, either six, seven, or eight in number, mounted on a set of corks which rested on a series of connected scissors-like slats. This part of the apparatus permitted lengthening or shortening of the row while preserving the straight line

---

[2]The RP procedure was a modified version of the conservation pretest; that is, if a subject made an incorrect response in the second phase of the trial, he was told to count the stars, to find which window he should have chosen. E then exposed the chip behind the window. In the A+S condition, on two thirds of the trials, following S's initial response after counting, E either added or subtracted a star at the end of the row before changing its length. The remaining third of the series consisted of straight conservation trails which were interspersed with the A+S trials. Unlike the first two training conditions, the Diss. procedure involved single-phase trials, with the length of the row varying from one trial to the next. S was urged to count the stars to open the corresponding window. In the control condition, the series also consisted of single-phase trials, but the length of the row remained fixed throughout the training session. The training was conducted over two sessions on two consecutive days. Each training series consisted of 18 trials, broken up into two sets of nine which were administered on the successive days.

arrangement. The subjects were told that they were going to play a game in which they should count the number of stars in front of them in order to find a chip hidden behind one of the three windows on the panel. The results showed an overall increase in nonverbal conservation responses from pretest to a posttest period, within the limited context of the learning task, but showed no significant differences attributable to the conditions of training. Transfer of conservation learning to the verbal posttest was neglible under all conditions. That is, none of the training procedures proved in any way effective in leading to an understanding of the principle of number conservation, such as the verbal posttest demanded.

Wohlwill and Lowe interpreted these results as indicating that whatever learning may have taken place was of a rather restricted type, representing perhaps more the formation of empirical rules than the understanding of a general principle. An example of two rules that a child may have formed was provided by the experimenters. One rule was "Look for the chip behind the window where the chip was just previously," and another rule was "The correct number remains the same as before, after the experimenter shortens or lengthens the row." Moreover, the researchers stated that their investigation highlighted the considerable gap separating the ability to enumerate collections by counting from a true understanding of the number concept as reflected in the principle of conservation.

An alternative explanation of Wohlwill and Lowe's results can be posited based on a major difference between their verbal and nonverbal tests of conservation. While the nonverbal test involved a match between a given collection of elements and the corresponding, symbolically indicated number, the verbal test entailed the equivalence of the numerosity of two collections of elements. Thus, it is conceivable that the children did in fact learn, in their nonverbal training, that the absolute number of elements remained unchanged, without transferring this principle to the relative number of elements in the two collections, in the verbal test. This possibility is borne out by the total inefficacy of asking the children to count the two collections after a nonconservation response on the verbal posttest. Of 23 subjects who were asked to do so, 19 persisted in their nonconservation responses; that is, they continued to assert that there were a different number of chips in the two rows immediately after ascertaining through counting that there were seven chips in each. Thus, it is plausible that children may show conservation in the first or absolute sense without showing it in the second or relative sense.

Smedslund (1961a) also argued for the very limited, nonconceptual nature of conservation learning on the basis of a study designed to assess learning of weight conservation. Forty-nine children, ages five to seven years, were exposed

to an extended series of judgments of the relative weight of two masses of plasticine, before and after one was deformed in shape. Each judgment was reinforced by weighing the two objects on a balance scale. While subjects did learn to correctly anticipate the conservation of weight of the deformed object, Smedslund believed that, based on both the verbal explanations offered by the children and the lack of transfer of the learning to generalization conservation measures, the learning was mainly that of an empirical fact rather than of a logical principle.

In an extinction procedure, Smedslund (1961b) found that these children, unlike children who had attained conservation outside of the experiment, readily returned to nonconservation if a bit of clay was surreptitiously taken away when a lump was transformed in shape. The extinction procedure consisted of confronting subjects with apparent nonconservation; the weight of the deformed object was altered by covertly removing or adding a small amount of plasticine. Under these circumstances, subjects who had acquired conservation through their learning experiences readily acceded to the lack of conservation which they seemed to be witnessing; that is, they abandoned their recently "learned" conservation. In contrast, subjects who had developed conservation spontaneously tended to invent explanations in order to reconcile this apparent contradiction, such as "we must have lost something on the floor."

Research utilizing verbal instruction did not yield superior conservation performance whether the presence of a verbalization was generated spontaneously by the subject or was provided to him through an experimental procedure. Such evidence was demonstrated by Inhelder and Sinclair-de-Zwart (1967). Their aim, in part, was to determine whether a child who still lacks a certain concept or operation would show "operatory progress" (i.e. demonstrate conservation) following verbal training. The aim of this training was to facilitate the acquisition of verbal expressions used by children who already prossessed the concept in question. In one set of experiments, they tried to teach children without conservation three attribute classes: (1) comparative terms (e.g. more/less; big/little); (2) differentiated terms (e.g. long/thick; short/thin); and (3) coordinated description of differences along two dimensions (e.g. short thick/long thin).

Pretraining baseline procedures consisted of assessing each child's performance on a series of conservation tasks (i.e. liquid and seriation) that required the understanding and use of target differentiated, comparative and coordinated terms. After explicit verbal training was provided on the target lexical items, each child's operational level was posttested in the conservation task. The results of these experiments are described below.

All the children learned the use of trained differentiated terms, and with relative ease. Whereas 75% of the children learned to use the comparative forms in the

training sessions, few children learned the use of the coordinated structures. More interestingly, even for children who succeeded in learning to use all the taught expressions, only 10% of them acquired conservation. On the other hand, more than half of the children who made no progress on the conservation task changed their answers in the posttest. Instead of simply using the level of the liquid to decide that there was more to drink in one of the glasses, they noticed and described the covarying dimensions of the glass beakers; however, this did not result in improved performance on the conservation task.

Inhelder and Sinclair-de-Zwart concluded that verbal training led subjects without conservation to attend to pertinent aspects of the problem, but did not ipso facto bring about the acquisition of conservation, or the meaningful use of the verbal forms. They used their findings to confirm Piaget's (1952) view on the role of language in the construction of intelligence; language is not the source of logic, but is, on the contrary, structured by logic.

In contrast, another study involving conservation (Beilin, 1964) showed that verbal training was effective in improving a child's performance on an area conservation task. The subjects of this study were mainly lower-middle class first and second grade children, 118 in each grade.

---

[3]Beilin used the term "quasi-conservation" to differentiate between the types of Piagetian tasks typically used in assessing area conservation. The usual conservation task

The study utilized a pretest-training-posttest design, and the subjects trained were only those who did not reach criterion for successful pretestperformance. The pretest consisted of obtaining a series of baseline judgments on three stimulus series: the "equality" series; the "quasi-conservation" series;[3] and the "inequality" series.

In the equality series, the child was shown two patterns equal in area whose configurations were the same (in 2x2 and 3x3 arrangements). In the quasi-conservation series, two patterns equal in area were also shown, but the match pattern had a different configuration from the standard. The areas were to be judged as equal even though the patterns were different. The third series of patterns represented area inequality, in that the match pattern was either one square larger or smaller than the standard. The areas appeared unequal and were unequal. The three stimulus sets, then, provided the child with the opportunity to judge the equality of two areas that appeared the same and were the same (i.e. equality), to judge another series that appeared different but was in fact the same (i.e. quasi-conservation) and still

---

(Piaget, Inhelder and Szeminska, 1960) requires the judgment that equality of areas is maintained in the face of physical transformation. The quasi-conservation task was considered to be an analogue of the classic conservation task in that the concept of equality had to be achieved in the face of a stimulus array that was different in a related attribute and where no physical transformation was performed in front of the child.

another series in which the pattern-pairs appeared different and were different (i.e. inequality).

Three training procedures were developed: one method was a feedback procedure in which the subject was given information as to the correctness or incorrectness of his responses. It was hypothesized that notification of an incorrect judgment would lead the subject to "question" his own inference of area inequality ostensibly made on the basis of a perceived difference in pattern arrangements. The feedback would lead him to use an alternative strategy that would produce a correct judgment. The two other training procedures were based on the supposition that the lack of ability to judge correctly was due to the subjects' lack of available solution strategies. One procedure utilized two patterns constructed of flat masonite blocks that were placed before the child in each trial. He was asked to count the number of blocks in each pattern but was not asked whether the patterns were equal. In the other procedure, two patterns were also set before the child and he was instructed to make his pattern look like the examiner's by moving only one block in the pattern.

The results of training were clear-cut. Only one posttest group had a significantly greater number of conservers than the control group. This was the feedback group, where 19 of 33 subjects met the conservation criterion after training, whereas only 4 of 33 in the control group reached the same criterion.

The results of this experiment confirmed that the basis for improved performance was not that the subjects in some way had

acquired a set of strategies previously unavailable to them. The results suggested, rather, that when confronted with the incorrectness of their prior inferences, subjects began a search for the appropriate strategy to deal with the perceived stimuli.

3. Cognitive Experiment - Training Linguistic Rules

In another study, Beilin and Kagan (1969) investigated the relationship between the child's conceptualization of number and the ability to learn pluralization rules. There were two parts to the study. The first part assessed knowledge of verbal pluralization rules and the ability to conceptualize the numbers one and two.[4] The second part was a training study; children who failed to reach criterion on the verbal-pluralization or number-conceptualization tasks, were trained on either or both.

On the pretest verbal-pluralization task, the experimenter presented and named two pictures, for example, "The fish is swimming/the fish are swimming", then pointed to each picture and asked, "What is the name of this picture"? The pretest number-concept attainment task was based on discrimination of a quantity property. Two cards with drawings of familiar animate and inanimate objects were presented side by side before the

---

[4]The singular-plural distinction is characterized by linguists as representing "one" versus "many" or "one" versus "more than one."

child. One card had a drawing of one object; the other had a drawing of two objects (for example, one sailboat versus two sailboats). The child was told to pick the winner by pointing.

Sixty-four children (35 boys and 29 girls) were selected for training after having failed one or both of the pretests. Sixteen children were assigned to each of five training conditions and the control condition. The children ranged in age from approximately 3 years, 1 month, to 5 years, 6 months, with a mean age of 4 years, 1 month.

Three of the training groups consisted of subjects who failed both verbal-pluralization and concept-attainment pretests (pass-neither group). The pass-neither group was randomly subdivided and given (a) number concept training, (b) pluralization training, or (c) number concept and pluralization training. Subjects who passed one of the pretests (pass-one group) comprised the other two training groups (i.e. pass-pluralization and pass-concept). The subjects who passed the pluralization test were given concept training; those who passed the pluralization task but failed the concept task were given concept training. The control group subjects were those who failed both pretests and received no training.

The training materials consisted of pairs of pictures of six kinds of wildlife. Two drawings placed side by side were simultaneously projected on a screen. One picture contained two animals engaged in the same activity (e.g. jumping). The

other contained two animals engaged in different actions (e.g. one jumping, one lying down).

In concept training, the subject was required to attain the concept "one animal (doing something)" or "two animals (doing something)." Following an incorrect response to the stimulus "Pick the winner," the experimenter stated, "One doing (something) wins" or "Two doing (something) win." There were 24 training trials. Verb-pluralization training consisted of the same type of rule-giving procedure. After an incorrect response to "What is the name of this picture?" (e.g. cat versus cats) the experimenter said, "We say 'is' when one is doing something" and "We say 'are' when two are doing something." There were 24 pluralization training trials. In the combined pluralization and concept training, there were 12 pluralization and 12 concept trials utilizing the same procedures as described above. Two posttests were administered. The first was given immediately following the training, and the second was administered one week following the first.

Results for concept scores generally paralleled those for language scores. The group that passed the pluralization pretest responded no better to concept training than the group that failed the pluralization pretest (which is consistent with pluralization performance results). As in the case of pluralization performance, training appeared to be the significant change agent independent of the language or concept status of the learner.

The authors' interpretation of the data was that neither the possession of concept ability nor pluralization ability alone leads to greater training gains than are seen in subjects who do not possess these abilities. The lack of transfer suggested that these systems are independent of one another. Considering the Piagetian concept priority thesis, the acquisition of linguistic rules in the group that failed to reach concept criterion is most puzzling. One explanation offered was the hypothesized independence of the integrity of language and concept rule systems. The language system, with its own rules and unique constituents, makes responses to natural events possible without reliance upon the rules of any other system. Although language and cognitive systems may, in some instances, have what appear to be parallel logics as in the case of number, successful use of the language system is possible without recourse to the cognitive system. An alternative and more likely explanation is that language may provide, through its rule system, analogues of logical structures or functions, which may be acquired without knowledge of the meaning usually associated with the logical structures themselves, as in the case of routines. In Beilin and Kagan's study, language intervention was viewed as expediting language acquisition and it was concluded that such training could be successful when conducted in a context specific fashion.

A comparison of the studies cited above reveals numerous factors that may account for both the different results

obtained and the varied interpretations of the data. These factors include: variability in the training procedures used; the length and intensity of intervention; the criteria established for demonstrating learning; the specific nature of different conservation operations themselves; and the conclusions drawn based on the childrens' performances. Until such factors are isolated, manipulated systematically, and compared across similar parameters, the efficacy of training to accelerate cognitive and verbal skills remains equivocal at best. Thus, within this body of cognition literature, it remains an empirical question as to whether the linguistic representation of a concept can serve to accelerate the acquisition of either cognitive or verbal skills.

Following the above selected review of intervention studies which explored the possible interplays between cognitive development and language acquisition, it is now appropriate to examine the research that focuses specifically on language processing skills of both adults and children. This section is organized into three major parts. Each part addresses the literature related to one of three competing hypotheses, the canonical-sentoid hypothesis, the interruption hypothesis, and the parallel function hypothesis, which attempt to account for how listeners understand sentences.

Canonical-Sentoid Hypothesis

1. Sentence Processing in Adults

Experimental results from a variety of studies of adult sentence processing suggest that an early stage in the decoding of sentences is the segmentation of the input sentence into clauses. The listener assigns grammatical relationships to an input sentence after segmenting the string into clauses. Several studies in this area (Ladefoged and Broadbent, 1960; Garrett, 1965; Fodor and Bever, 1965; Garrett, Bever, and Fodor, 1966; Bever, Fodor, and Garrett, 1966; Bever, Lackner, and Kirk, 1969) support the existence of a clause segmentation strategy based on canonical order. Essentially, data from these studies suggested that an initial step in the organization of an input word string is the isolation of the clauses in the surface order which correspond to the underlying structure of a sentence.

For the canonical-sentoid (SVO) strategy to work, there can be no clause boundary intervening in the NP-V-(NP) string. Therefore, the application of this heuristic should interfere with the processing of sentences which do not conform to the canonical order analysis making such sentences more difficult to understand. In using the SVO strategy, a listener initially hypothesizes that the order of surface elements corresponds to the underlying order. A review of the literature provides evidence that hearers tend to employ the SVO strategy even when word strings do not conform to such an analysis. Studies that have compared the

comprehension of active and passive constructions have shown that passive sentences are more difficult to process than their active counterparts. Using a variety of experimental tasks, Gough (1960), Savin and Perchonock (1965), Blumenthal (1967) and other investigators found that passive sentences took longer for their subjects to process than their corresponding actives. In the case of passive sentences, such as "The boy was hit by Susie," the listener must process cues leading to falsification of the initial hypothesis and construct a more appropriate one.

Using a different procedure, speed of comprehension, Forster and Olbrei (1973) offered conflicting data on reversibility. Their findings showed that passives took longer to process than actives regardless of reversibility. Based on their results, they argued that semantic variables do not affect the immediate syntactic processing of a sentence although they may influence the speed at which such sentences are ultimately interpreted.

Falsification of the initial SVO strategy is not always achieved by listeners, as evidenced by the type of errors they make in interpreting complex sentences. Fodor, Bever, and Garrett (1974) noted that the use of the SVO strategy led listeners to experience difficulty in understanding sentences such as (2-3).

(2-3) The horse raced past the barn fell.

Subjects tended to interpret such sentences as simple actives until they reached the final word, whereupon they reassessed

their hypothesis, generally reaching the erroneous conclusion that they heard an anomalous sentence.

A number of other studies also find support for the canonical-sentoid hypothesis. Wanner and Marastos (1971) and Walker (1969) demonstrated such an effect with sentences containing relative clauses. They compared singly embedded sentences which contained either subject relative clauses (where the relative clause subject is replaced by a pronoun) or object relative clauses (where the relative clause object is pronominalized). Examples of these constructions are seen in (2-4) and (2-5), respectively.

(2-4) The girl/who pushed Bill/fell.

(2-5) The girl/whom Bill pushed/fell.

The canonical-sentoid hypothesis predicts that relative clauses in which the subject NP is relativized will be easier to process than relative clauses in which the object NP is relativized. In subject relative sentences, the surface order of the constituents presumably corresponds to the underlying SVO order. Thus, the application of the SVO strategy will result in a correct interpretation of such clauses. However, in the case of the object relatives, the order of the constituents in the surface structure does not parallel the underlying order so that the SVO strategy cannot be applied here successfully. In fact, both studies found evidence that the object relative form was more difficult to process than the subject relative form. Such findings suggest a hearer preference for structures for which the SVO

strategy produces the correct analysis.

2. Sentence Processing in Children

The effects of word order on sentence processing are relevant to a discussion of sentence comprehension for children as well as for adults. The absence of inversion of the subject and auxiliary in the early form of such yes-no questions as "I can go?" and in Wh-questions such as "Where I can go?" (Brown, Cazden, and Bellugi, 1969; Klima and Bellugi, 1966) illustrates the child's resistance to word order changes.

There is a substantial body of data which indicates that just as direct correspondences between the surface and underlying analysis of a linguistic form facilitates the processing of that form in the case of adults, it also predicts relatively early acquisition of that form for children. Conversely, sentences whose surface structure organization distorts the underlying structure relations appear to be a relatively late acquisition for the child, just as they are more difficult for the adult to process (Fodor, Bever and Garrett, 1974).

A study conducted by Olds (1968) emphasizes the degree to which explicitness of base relations in a sentence facilitates the child's ability to comprehend it. Olds examined the relative abilities of children to follow such directions as "Ask your opponent which piece to move one space" versus "Ask your opponent which piece you should move

one space." The former sentence differs from the latter in that the subject of "move" is deleted in the former and is explicit in the latter. Thus, for the latter sentence, the underlying relations are more clearly marked in the superficial string. Olds' results indicated that the sentence in which the embedded pronoun was reduced proved to be more difficult for the children studied. Of the 30 children who misinterpreted the first instruction with "ask" minus pronoun, 16 correctly interpeted a subsequent instruction with "ask" plus pronoun.

With regard to word order, there is a distinction between the canonical-sentoid strategy used by adult speakers and the word order strategy employed by young children during the language learning years. Adults exercise their linguistic competence and generally arrive at the correct interpretation of a sentence, though the degree of processing complexity involved in decoding an input sentence varies depending upon (among other variables) the word order arrangement in the superficial structure. Children, on the other hand, depend on strategies to a greater extent and frequently misinterpret sentences that violate their hypothesis, partly because they lack the linguistic competence to perform complete linguistic analyses.

Bever (1970) stressed the importance of canonical order strategies by observing children's manipulation of objects to act out incoming sentences. Bever (1970) indicated that during the course of language development, children as young

as two years old go through a stage where they interpret the first noun of a sentence as the logical subject and the last noun as the logical object (in sentences which do not have semantic constraints). Reliance on this "First-Noun Strategy" peaks at 3½ years of age, when children interpret the first noun of the sentence as the actor independent of its surface relation to the verb.

Canonical-sentoid strategies, then, not as developed as those of adults, begin as First Noun/Actor strategies. The existence of the First Noun strategy is clearly illustrated when children encounter reversible passive sentences. A reversible passive sentence is one which "makes sense" when the subject and object NP's are interchanged. Thus, "the boy was pushed by the girl" is considered reversible because girls can push boys and vice versa. In contrast, "the ice cream cone was eaten by the girl" is considered non-reversible; the interchangeability of the noun phrases cannot operate in such a sentence. Using a toy manipulation task, Bever, Mehler and Valian (1970) found that 3- and 4-year old children adopted a First Noun strategy and frequently misinterpreted reversible sentences; that is, the children's errors indicated that they interpreted the first noun as the logical subject of the main verb and the second noun as the logical object of the main verb.[5] Analogous

---

[5]This type of error only occurred with reversible passives, when semantic cues were unavailable to the child.

results were reported by deVilliers and deVilliers (1972).

Simarily, Bever (1970) and Beilin, et al. (1975) have noted that children demonstrate the same kind of difficulty with object first cleft sentences (e.g. "It's the car that the truck hit") versus subject-first cleft sentences (e.g. "It's the truck that hit the car") as they do with passive-active counterparts. A similar situation occurs with NNV (e.g. "the cow the horse kisses") versus VNN (e.g. "Kisses the cow the horse") nonsense sequences. Bever (1970) found that his subjects' errors conformed to the First Noun strategy; the children interpreted the first noun as the actor in both VNN and NNV sequences. In another study, Davis and Blasdell (1975) compared normal-hearing and hearing-impaired children's comprehension of sentences containing embedded relative clauses (e.g. "The man/who chased the sheep/cut the grass"). Their subjects ranged in age from 6- to 9-years old. Results of this study indicated that the hearing-impaired subjects, as well as the normal-hearing subjects, employed a First Noun strategy to interpret the embedded relative sentences. These data corroborate Bever's (1970) hypothesis, and more

---

Accordingly, in the non-reversible situation, Bever, et al. (1970) concluded that since the First Noun strategy produces an incoherent interpretation, the interpretation is rejected and a full syntactic analysis is applied. Similar findings were reported by Slobin (1966) with 6- and 7-year old children using a picture verification task.

interestingly, demonstrate that a clinical population relied on the same heuristics to process sentences as those used by normal children.

C. Chomsky (1969) was also interested in variables that affect comprehension in children. More specifically, she was concerned with the development of comprehension strategies for relating specific elements of the surface structure of sentences to properties of their underlying organization in terms of which noun phrase in a sentence is the logical subject of that sentence. Chomsky studied the ability of children between 5- and 10-years of age to understand four types of syntactically complex sentences. One type of construction that Chomsky examined involved sentences containing complement verbs. Consider the following sentences.

(2-6) Bill promised John to leave.

(2-7) Bill told John to leave.

Sentence (2-6) means that Bill promised John that Bill would leave. Here Bill is the subject of the complement verb to leave. Conversely, in (2-7), it is John that is leaving, which makes John the subject of the complement verb to leave. The technique utilized to study this structure was a toy manipulation task; the child was given dolls and asked to act out situations that were presented orally by the examiner. For example, "Bozo tells Donald to lie down; make him do it," versus "Donald promises Bozo to lie down; make him do it."

Of the 40 children tested, 19 made errors. Ten were consistent and performed every "tell" sentence correctly and every "promise" sentence incorrectly. The remaining nine children were inconsistent in their responses; four gave mixed responses to both words, and five gave mixed responses to "promise" sentences only performing all "tell" sentences correctly.

Based on Chomsky's analysis of the subjects' error responses, she identified the Minimal Distance Principle (MDP) as a strategy that children use for understanding sentences with complement verbs. The MDP states that the subject of the complement verb (i.e. a verb with "to") is judged to be the NP most immediately preceding it. Chomsky found that children somewhere between 5- and 8-years old applied the MDP to both sentence types and consistently misinterpreted the "promise" sentences, presumably because they are always an exception to the MDP and therefore violated the child's comprehension strategy. Thus, at this point in development, the child's system for dealing with verbs in the complement construction studied is uniform; he assigns NP2 as complement subject consistently following both test verbs. Chomsky hypothesized that a child may first learn the MDP and only later learn the exceptions.

An alternative but compatible explanation for Chomsky's findings is that since the surface order of sentence (2-6) does not reflect the underlying structure in an explicit way, the clause segmentation process becomes confusing and it is

therefore more difficult for the younger subjects to recover the canonical order of the clauses in the complement sentences used in this study. It is interesting to note that for most verbs, the MDP works, hence confirming an operating principle of Slobin, namely, "Pay Attention to the Order of Words and Morphemes" (Slobin, 1973, p. 348). Slobin, observing the early acquisition of comprehension across many languages, found that children tended to use canonical order strategies in their attempts to understand sentences.

Chomsky also demonstrated that children have difficulty correctly interpreting infinitival complement (for/to) sentences such as "John is easy to see" versus "John is eager to see", where the surface subject corresponds to the object in the underlying structure. Children as old as six years interpreted the first noun in such sentences as the subject. In her study, Chomsky placed a blindfolded doll in front of the child and asked, "Is the doll easy to see or hard to see?" The "easy-eager" contrast is analogous to the "promise-tell" contrast in that the difficulty of interpretation is related to the explicitness with which the surface structure form marks the underlying relations. The word order relationship between John and easy in the surface structure mistakenly suggests that John is the logical subject of the verbs, rather than the logical object (Fodor, Bever and Garrett, 1974).

Cromer (1970) revised Chomsky's procedure and examined the for/to construction to determine which features of input

sentences are used by children to recover the underlying structure in their efforts to understand a sentence. Cromer distinguished among three classes of adjectives: subject adjectives as in (2-8); object adjectives as in (2-9); and ambiguous adjectives as in (2-10).

(2-8) The wolf is eager to bite.

(2-9) The wolf is easy to bite

(2-10) The wolf is nice to bite.

The same sentence frame, "The wolf/duck is adjective to bite", was used for all three types of adjectives. The interpretation of the underlying subject or object is determined by the adjective. In the case of the subject adjective sentences, the underlying subject corresponds to the surface structure subject. In the object adjective sentences, the underlying subject does not coincide with the surface object. Rather, it corresponds to the surface object, indicating that it is someone other than the wolf that is doing the biting. The sentences containing the ambiguous adjectives can have either interpretation; that is, (2-10) is ambiguous with respect to whether the wolf is the underlying subject or the underlying object.

Cromer observed children's manipulations of duck and wolf puppets to sentences such as (2-8), (2-9), and (2-10) above. His subjects ranged in age from 5- to 7-years old. They were told to show the experimenter whether it was the wolf or the duck that was doing the biting. Cromer indicated that

children looked for the subject of the infinitive (to bite). Their responses were correct when the first noun, wolf, as in (2-8) was the subject-actor. More errors were made when the first noun was the object-recipient of the infinitive wolf, as in (2-9). Cromer provided additional evidence for the operation of the First Noun/Actor strategy. His subjects did not consistently, and accurately, respond to types such as (2-9) until after 6½ years old. Furthermore, these findings do not appear to be task-specific. Kessel (1970) replicated Cromer's findings using a picture discrimination format where the child's response involved choosing between pictured stimuli.

To summarize, the studies on children discussed above suggest that children are especially sensitive to shifts in word order and, further, that the word order changes in sentences may contribute to the difficulty in learning certain types of constructions. Hence, it seems clear that a basic expectation that the child brings to the task of language development is that the order of elements in an utterance that he hears can be related to the underlying grammatical relationships. In addition, it appears that part of the child's developing linguistic capacity involves the formulation of ad hoc comprehension strategies for performing structural analyses on input strings; the evidence is persuasive that one such sentence-processing strategy is based on the canonical order of sentential constituents - the First Noun Strategy.

Interruption Hypothesis

1. Sentence Processing in Adults

Miller's (1962) formulation of the interruption hypothesis was based on evidence gathered from adults' comprehension of multiply-embedded sentences, such as "The rat the cat the dog chased killed ate the corn." Miller and others (Miller and Chomsky, 1963; Miller and Isard, 1964, etc.) found that self-embedded (SE) sentences were more difficult to understand than right-branching (RB) sentences that had the same number of clauses. Unlike the SE sentences, in RB sentences, the internal structure of each clause is preserved, containing no within-clause interruptions. Therefore, each clause may be analyzed relatively independently and completely as it occurs.

However, these studies do not show that the effect of interruption, per se, is either necessary or relevant to an explanation of adults' processing difficulty. This is true for several reasons. First, the experimental sentences used by these investigators were so bizarre that their subjects (and adults, in general) probably did not process them as sentences at all. Moreover, they are rarely used in everyday conversation. In addition, observations about the difficulty of interruptions were based on studies which examined only multiply-embedded relative clauses (Blumenthal, 1966; Fodor and Garrett, 1967; Foss and Lynch, 1969; Stolz, 1967). The use of such sentences precluded the possibility of isolating

the effect of interruption from the effect of self-embedding. Thus, these experiments provide rather weak and insufficient evidence in support of the interruption hypothesis. In order to confirm this hypothesis, it would at least be necessary to show that SE sentences with one embedding are more difficult to process than comparable RB sentences.

Hakes, Evans, and Brannon (1976) found no such evidence with adults using more "normal" embedded sentences. Employing paraphrase and phoneme-monitor tasks, these researchers attempted to test the interruption hypothesis using college undergraduates as subjects. The test stimuli consisted of SE and RB sentences, half of each containing subject relative clauses and the other half containing object relatives. The results showed that in sentences containing the object relatives, the phoneme-monitoring task was faster for SE than for RB sentences, a finding which is in the opposite direction from that predicted by the interruption hypothesis. Although there was no significant difference in the monitoring speed between SE and RB sentences containing subject relatives, additional evidence was found that SE sentences were easier to process than RB's. Moreover, paraphrases were more accurate for the former type in both subject and object relative conditions. Thus, the results of this investigation did not provide evidence that embedding increased processing complexity in adults. Hakes, Evans, and Brannon concluded that earlier findings in support of the

interruption hypothesis were biased due to confounding variables; the SE sentences studied always contained object relatives, while RB sentences always contained subject relatives.

In another study, Baird and Koslick (1974) sought to test both the canonical-sentoid and interruption hypotheses. They predicted that differences in relative clause sentence types should produce differential effects in recall of grammatical relations in the experimental sentences. More specifically, they formulated the following two hypotheses: (1) subjects would make more errors in recalling $V\text{-}NP_{object}$ relations in object relative sentences than in subject relative sentences (referred to as "object focus" and subject focus", respectively); and (2) subjects would make more errors in recalling $NP_{subject}$ -V relations in SE sentences (or as they termed it, "nested" constructions) than in RB (or "not nested") sentences. Their results supported the first prediction; recall was poorer for $V\text{-}NP_{object}$ relations in object relative sentences than in subject relatives. The second prediction was not supported by their data; there was no difference in recall of $NP_{subject}$-V relations in SE and RB sentences.

Baird and Kolsick attributed the difficulty in recalling $V\text{-}NP_{object}$ relatives in object relative sentences to the permutation of word order in the relative clause, and not to the fact that NP_{object} is represented by a pronoun rather than a lexical item. If the latter explanation were true,

then the second prediction would have been supported.

The authors pointed out that conflicting results in previous studies (Miller and Isard, 1964; Baird, 1973) might have been due to retrieval ability rather than to differences in encoding; that is, a memory effect rather than a comprehension effect. This analysis was supported by Baird (1974), who found that although verbatim recall of SE sentences was inferior to recall of RB sentences, recognition accuracy was not significantly different for the two types.

2. Sentence Processing in Children

Studies have demonstrated that children, like adults, have difficulty in dealing with material interposed between related parts of a sentence. Studying children, Slobin (1971) found support for the interruption hypothesis. He indicated that interruption of linguistic units makes sentence processing more difficult. His data showed that relative clauses which modify subjects (subject relatives) such as (2-11) were more difficult for young children to

(2-11) The man/ that fell down/ran away.

(2-12) I saw the man/that fell down.

understand than relative clauses which modify objects (object relatives) such as (2-12). Slobin accounted for these results by noting that subject relatives break up the subject/verb relations of the main clause and hence put a greater strain on short-term memory than do object relatives.

Brogan (1968) analyzed imitation data of preschoolers and found that self-embedding was related to imitation difficulty rather than to sentence length or to the number of embedded clauses. Brogan showed, for example, that sentences (2-13) and (2-14) were easier for his subjects to imitate than sentence (2-15), which posed considerably difficulty.

(2-13) He knows how to read/because he goes to school.

(2-14) I saw the man/who fell down.

(2-15) The man/that fell down/ran away.

Interruption does seem to affect sentence processing in children. However, the paucity of research and differences in the tasks used to examine this variable precludes clarification of how interruption functions in child comprehension and language learning.

Parallel Function Hypothesis

Sheldon (1974) originally found that variables other than interruption of the main clause and word order affect children's comprehension of relative clause sentences, and she developed the parallel function hypothesis as an alternative explanation. In contrast to the canonical-sentoid hypothesis and the interruption hypothesis, the parallel function hypothesis was first formulated to predict the differential processing complexity of relative clause constructions for children. Sheldon reasoned that if self-embedding is difficult for adults, then it would be

natural to expect that this aspect of linguistic structure would be difficult for the language learner, since children's linguistic abilities depend greatly on their short-term memory (STM), which is more limited than adults'.

To test the parallel function hypothesis, Sheldon considered the underlying role of the relativized noun as a subject or object within main and subordinate clauses. Recall from Chapter I that a relative clause sentence can have a parallel function or a nonparallel function depending upon the function of the noun in both clauses. Sheldon's test sentences can be described as one of four relative clause sentence types: SS, SO, OO, OS, where S represents "subject" and O represents "object." Examples of the four types are displayed below.

(2-16) SS The giraffe/that bites the wolf/kicks the hippo.

(2-17) OO The hippo bites the zebra/that the bear jumps over.

(2-18) SO The wolf/that the hippo stands on/kisses the zebra.

(2-19) OS The alligator chases the tiger/that bites the lion.

The first of the two letters in each sequence refers to the function within the main clause of the NP that is modified by the relative clause. The relative clauses modify either the subject NP (in SS and SO sentences) or the object

NP (in OO and OS sentences) of the main clause. Sentence (2-16) represents a subject relative with subject focus. "Focus" refers to the underlying function of the relativized noun within the relative clause. This sentence type is termed SS. On the other hand, the relativized noun zebra in sentence (2-17) is the object/recipient of both main and relative clauses. Sentence (2-17) represents an object relative with object focus and is termed OO.

The second letter in the sequence refers to the function of the relativized NP within the relative clause. In nonparallel sentences, where the noun is the subject in one clause and object of another, the noun has a split function. For example, the relativized noun, wolf in sentence (2-18) is the subject of the main clause and the object of the relative clause. Sentence (2-18) represents a subject relative with an object focus and is termed SO. The relativized noun tiger in sentence (2-19) is the object of the main clause and the subject of the relative clause. Sentence (2-19) represents an object relative with a subject focus and is termed OS.

Using a toy manipulation task, Sheldon (1974) observed and recorded children's responses to these four types of relative clause sentenes. A set of coordinate sentences (i.e. two-clause constructions joined by the conjunction and) were used as controls to rule out short-term memory as the major processing variable. The coordinate sentences served as controls for the embedded relative clause sentences. For example, sentence (2-20) is an SS coordinate.

(2-20) The giraffe kicks the hippo and the giraffe bites the wolf.

The subjects consisted of normal children in three different age groups. In Group I, subjects ranged from 3 years, 8 months, to 4 years, 3 months; Group II subjects ranged from 4 years, 6 months, to 4 years, 11 months; and Group III subjects ranged in age from 5 years, to 5 years, 5 months.

In this experiment, Sheldon found no support for Slobin's (1971) proposed constraint against interruption or against rearrangement of linguistic units. First, her results showed that the coordinate sentences, such as (2-20) were significantly easier for the children to process than any of the relative clause sentence types. Since her subjects were able to act out sentences containing two propositions, she concluded that sentence length was not a confounding factor.

In addition, the different types of relative clause sentences resulted in different degrees of processing difficulty. Sheldon reported that performance on the parallel function sentences, SS and OO relatives, was significantly better than performance on the nonparallel function sentences, SO and OS relatives, for all age levels tested (Table 2-1).

Of particular interest is the processing ease hierarchy of the four relative sentence types for Sheldon's youngest age group (3 years, 8 months - 4 years, 3 months), since this group approximates the age range examined in the present

TABLE 2 - 1

MEAN SCORES ON RELATIVE CLAUSE SENTENCES
ACCORDING TO AGE AND SENTENCE TYPE IN SHELDON'S (1974) STUDY

From Sheldon (1974), p. 276. With the permission of the publisher, Academic Press, New York, and the author.

TABLE 3

MEAN NUMBER OF CORRECT ANSWERS BY AGE GROUP: RELATIVE SENTENCES (3.0 possible)

Age group	Sentence Type SS	SO	OS	OO
I (3.8–4.3) N = 11	1.0	.18	.54	1.36
II (4.6–4.11) N = 11	1.45	.73	.91	1.64
III (5.0–5.5) N = 11	2.27	.64	1.17	1.55
Avg. Mean Score N = 33	1.58	.52	.88	1.52

---

study. From easiest to most difficult, the hierarchy was OO SS OS SO. In fact, only Sheldon's oldest group (5- 5½ year olds) deviated from this hierarchy (i.e. SS > OO > OS > SO). As the data in Table 2-1) show, neither self-embedding (interruption of the main clause) nor violations of canonical word order were found to be significant variables; that is, these factors did not account for the children's patterns of errors.

SS sentences showed the most improvement with age, so that the Group III subjects performed better than the Group I subjects on this particular relative clause sentence type. The children's performance on the OO sentences remained essentially the same across all ages tested. Errors could be accounted for by Sheldon's parallel function hypothesis and by the children's overreliance on the rule of "extraposition from NP." In analyzing errors as well as correct responses, Sheldon (1974) identified two strategies employed by the children in their attempts to comprehend sentences containing relative clauses:

(1) The parallel function strategy - assume that the relativized pronoun has the same grammatical function as its antecedent.

(2) The extraposition strategy - interpret all relative clauses that follow the main clause as modifying the subject of the main clause.

According to Sheldon, reliance on either of these strategies can explain the children's overall better performance on the

SS sentences. For SS sentences, the relativized noun has the same function (i.e. subject) as its antecedent as in (2-21).

(2-21) The giraffe/that bites the wolf/kicks the hippo.

In addition, the relative clause modifies the first noun.

SO and OS relatives proved to be most difficult for Sheldon's subjects to interpret correctly. Both sentence types contain nonparallel relationships and demonstrate violations in canonical order. Indeed, many of the errors on SO sentences involved assuming that the first noun was the actor in both clauses in sentences such as (2-22), resulting from the application of the parallel function strategy. OS sentence

(2-22) The wolf that the hippo stands on kisses the zebra.

errors frequently involved a combination of parallel function and extraposition strategies as in (2-23) and (2-24) below.

(2-23) The alligator chases the tiger that bites the lion.

(2-24) The alligator that bites the lion chases the tiger.

Sheldon (1974) noted that the two strategies often overlapped. However, based upon the superior performances on the SS and OO sentences she concluded that parallel function was responsible for the overriding effect.

Brown (1971) who was also interested in children's comprehension of relative clause sentences, looked at the

ability of 3-, 4- and 5-year olds to perform a sentence-to-picture matching task. Brown found that subject focus relatives, SS and OS sentences, were significantly easier for his subjects to understand than object focus relatives, OO and SO sentences. For subject focus types, SS were easier to understand than OS sentences. For object focus sentences, OO were easier to understand than SO sentences. He also found improved performance with age; that is, the 4- and 5-year olds performed better than the 3-year olds.

The results of both Sheldon's (1974) and Brown's (1971) studies indicate SS relatives to be the easiest type and SO relatives to be the most difficult relative clause type. Sheldon (1974) found that both kinds of parallel sentences (SS and OO) were significantly easier to understand than the nonparallel sentences (OS and SO), whereas Brown (1971) indicated that focus was the overriding variable. His data showed that the subject focus sentences (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 study, although it was not found to be significant in Sheldon's study. The primary discrepancy between these two studies is the children's performance on the object relative sentences.

Perhaps part of the dicrepancy can be accounted for by the fact that Brown and Sheldon used different materials and employed different tasks to assess comprehension in their 3 to 5 year olds. Sheldon used all animate nouns and required

subjects to manipulate toys. Brown, on the other hand, used both animate and inaminate nouns and required subjects to select the correct picture to represent the sentence from a choice of two pictures. In any case, the different results obtained by these two researchers point out clearly that the variables of parallel function, relative clause focus, and canonical order require further study.

In a later investigation, Sheldon (1977) examined how English-speaking adults process the same four types of relative clause sentences used in her earlier work. She compared their behavior to the performance of the 4- and 5-year old children from her previous work to discover if parallel function that had a similar effect on adult language behavior, or if it was only relevant to children. She predicted that although the child study did not confirm Slobin's (1971) predictions about either the difficulty of interruption or the difficulty of word order arrangement, the case may be different for adults.

Forty-nine native English-speaking college students participated in the study. Sheldon used a different procedure with the adults than she had used with the children, because a preliminary investigation determined that a toy moving task was too easy for adults. Instead, she presented the sentences to the adults auditorily and used a memory probe to measure processing difficulty. After hearing the sentence, for example, "The boy that saw the girl hit the man", the subject was asked two questions. One questioned

the main clause action, for example, "Who hit whom?", and the other questioned the relative clause action, for example, "Who saw whom?" Three-second intervals were used between hearing the relative clause sentence, presentation of the first question, and presentation of the second question. Each subject heard 20 examples of each of the four types of sentences for a total of 80 sentences.

In contrast to the child study, the results of the adult study supported Slobin's generalization about the difficulty of interruption and word order rearrangement. Moreover, no discernible effect of parallel function was found. There was a siginificant difference in the level of performance on the relative clauses depending upon which NP was relativized. In other words, relative clauses in which the object NP, the SO and OO types, was relativized were significantly harder than the relative clauses in which the subject NP, the SS and OS types, was relativized. The order of sentence type difficulty from easiest to hardest, was OS > SS > OO > SO. Given task differences, Sheldon's adult data were similar to that of the Brown's (1971) child data.

However, upon analyzing main clause errors, Sheldon found a significant difference in the level of performance depending upon the position of the relative clause in the sentence. That is, main clauses that were interrupted, the SO and SS types, were significantly harder than main clauses that were not interrupted, the OS and OO types. To account for the apparent difficulty posed by interruption and word

order, Sheldon identified the "Adjacency Strategy" as the most economical way of explaining the errors made by her subjects. The adjacency strategy was defined as follows: in parsing a noncompound sentence, starting from the left, group together as constituents of the same construction, two adjacent NP's (i.e. not separated by other NP's) and an adjacent, noninitial verb that has not already been assigned to a clause. Interpret the first NP as the subject of the verb, and the second NP as the object of the verb (Sheldon, 1977, p. 312).

In an OS sentence, "The boy hit the man that saw the girl", for example, the adjacency strategy would segment "The man that saw the girl" as the second clause, ignoring the relative pronoun. This strategy would yield a correct response for the OS type only. Sheldon further argued that application of the adjacency strategy would result in most errors on the SO sentences, because it would fail to segment either clause correctly, while the strategy would segment one of the clauses of the SS and OO sentence type correctly.

Based on Sheldon's adult study, she reexamined the errors made by the 4- and 5-year olds in her previous investigation and argued that both adults and children followed the same strategies in processing these sentences. The difference between these two groups was the degree to which they relied on each strategy, and consequently, which sentence types they erred on most

frequently.

For example, Sheldon calculated that 51% of the children's main clause errors on SS sentences could be accounted for by overreliance on the adjacency strategy, while 30% were due to parallel function. In contrast, most of the children's errors on the SO type could be explained by an overreliance on the parallel function strategy and with only minimal use of the adjacency strategy. On the object relatives, OO and OS, application of the extraposition strategy accounted for 65% and 69% of the children's error responses, respectively.

Thus, Sheldon concluded that the prohibition of interruption and word order rearrangement is less important for the child than for the adult. She explained the extent to which these two groups overused different strategies.

Related Studies

Recently, Wallach (1977) tested the comprehension of relative clause sentences in normally-achieving and learning-disabled children between the ages of 8 years, 6 months, and 13 years, 9 months. In part, she was interested in identifying the comprehension abilities and strategy styles used by these children in processing embedded relative clause sentences. Using a toy manipulation task similar to that used in Sheldon's child study (1974), Wallach assessed these children's

understanding of four relative clause sentence types heard in the following three conditions: (1) in isolation; (2) after thematized narratives; and (3) after nonthematized narratives.[7] Wallach incorporated thematization to gain additional insight into the way prior information affects listeners' perceptions about the relations contained in the stimulus sentence.

Since the present study was designed to explore the language processing strategies employed by young normal children, this report of Wallach's results will focus on the performance of her normally-achieving (control) subjects. Moreover, this account of Wallach's data will first present the normal subjects' responses to relative clause sentences heard in isolation and then will consider the effects of thematization. Since Wallach's task used in the isolated sentence portion of the study is comparable to that used in the present study, as well as comparable to Sheldon's (1974) and to Feier's (1977) studies, individual sentence processing abilities can be compared and contrasted between younger children, older children, and

---

[7]Thematization involves how certain features of sentences in connected discourse are made more salient for the listener. In Wallach's study (1977), thematized stories were paragraphs which contained a central or main character, who was referred to often in the narratives. Nonthematized stories were paragraphs which did not contain a main character; all characters were mentioned with equal frequency in the narratives. The theme always served as the grammatical subject of the narrative.

elderly people without having to account for confounding variables of task differences. These comparisons will be discussed in Chapter V, following presentation of results from the present study.

Of sentences heard in isolation, 65% of Wallach's normal subjects achieved perfect or near perfect (one error) scores. The errors made by the normal group clustered on the subject relatives, the SS and SO sentences. That is, subject relatives with subject focus (SS) were found to be easier than subject relatives with object focus (SO). The hierarchy for ease of processing the four relative clause sentences in Wallach's normal subjects was OO > OS > SS > SO, from easiest to most difficult. This hierarchy differed from Sheldon's oldest group (Table 2-1).

Wallach reported that these results provide some evidence for the interruption hypothesis proposed by Miller (1962) and Slobin (1971). However, Wallach indicated that performance of her younger normal subjects was better accounted for by the operation of a more all-encompassing temporal-order strategy (i.e. assume that the first, (or the last), N-V-N sequence is the actor-action-recipient of that sequence).

Thematization effects will now be considered. In the nonthematized condition, seven errors were made on SO sentences, in comparison to near perfect performance made in the thematized condition, indicating that thematization had a facilitating affect on comprehension. Although the normal children performed almost equivalently on SS sentences after

both thematized and nonthematized stories, SS sentences were much easier to process than SO sentences in the nonthematized condition; but, subject relatives presented more difficulty overall, than object relatives, in the nonthematized condition. On subject relative sentences heard after nonthematized stories, the normal children used the same strategies that they used on the isolated sentences.

On object relatives, the normal children made a total of only four errors. Their performances in terms of strategy use and number of errors made generally remained unchanged between thematized and nonthematized conditions. However, as Wallach pointed out, it is difficult to make a strong argument for comprehension strategy preference for the normal children in view of the general ceiling effect in this group after about 9½ years of age. Moreover, since she did not report a breakdown of strategy use by age, it is difficult to speculate further on age-related strategy use. It can be postulated that older normal children were using competency-based strategies; that is, internalized knowledge of the adult grammar plus comprehension strategies. It could also be noted that the temporal/NVN strategy proposed by Wallach to account for the normal subjects' inferior performance on the SS and SO sentences when heard in isolation and in the nonthematized versions, is not inconsistent with the predictions of the canonical order hypothesis. In both cases, the children relied heavily on word order to interpret stimulus sentences.

Feier (1977) used the same four types of relative clause sentences that were studied by Sheldon (1974) and by Wallach (1977) to determine whether language comprehension abilities decrease with normal aging. Feier's study was designed to discover the order of difficulty among the sentence types, to test three sentence processing hypotheses (canonical-sentoid hypothesis, interruption hypothesis, parallel function hypothesis), and to identify the comprehension strategies that the subjects used to interpret the stimulus sentences.

Sixty adults within four age groups (18-25 years; 52-58 years; 63-69 years; and 74-78 years) were studied. The youngest group served as the control group. The task involved manipulation of objects in response to a predetermined set of SE (So and Ss) and RB (Os and Oo) sentences. Half of each type of stimulus sentences contained subject relative clauses and half contained object relative clauses. Similar to Wallach's (1977) methodology, Feier's sentences were presented in isolation and after narratives to determine whether the contextual antecedent provided by the narrative facilitates comprehension. Both thematized and nonthematized narrative versions were used.

Feier's results showed marked differences in language comprehension performance across the adult age range tested. She found that subjects in the youngest experimental age group (52-58 years) performed similarly to that of the control group (18-25 years), exhibiting the same error rate. Overall error rate for all groups was only 17.2%. However,

performance began to decline among subjects in their 60's and proceeded to drop sharply thereafter. The oldest group (74-78) years) made most errors on every sentence type. No significant relationship was found between thematization or nonthematization on error rate or sentence type.

Despite the low error rate, Feier found a patterned order of difficulty among the relative clause sentence types. The parallel function sentences, Ss and Oo, the easiest, were not significantly different from each other in error rate. The nonparallel sentences, Os and So, had the highest error rates, with So being the most difficult. Feier's obtained hierarchy of processing difficulty mirrored that of Sheldon's (1974) oldest child subjects (5-5½ years); Ss > Oo > Os > So, from easiest to most difficult. Sheldon's parallel function hypothesis accounted for these data, while no support was found for either the interruption or the canonical-sentoid hypotheses: listeners had no more difficulty enacting SE sentences as a group than RB sentences. Moreover, they had no more difficulty acting out object relatives than subject relatives.

In attempting to explain the far greater number of errors in the nonparallel So sentences than in their Os counterparts, Feier argued for the temporal strategy, which she described in terms of three principles. These were: (1) a noun following a verb will be acted out as the object of that verb; (2) a noun preceding a verb will be acted out as the subject of that verb, and any as yet unspecified noun as

the object; and (3) the first heard noun will be enacted as the subject of the first heard verb, and the second heard noun as the object of the first heard verb. The third principle is applicable only to So sentences where it can replace Principle 2. According to Feier, these principles operate sequentially; Principle 1 is applied before Principle 2, or in the case of So sentences, before a choice is made between Principles 2 and 3.

It seems that in Feier's (1977) and Wallach's (1977) investigations, as well as in Sheldon's (1977) study with adults, subjects' overreliance on a temporal strategy can be identified as the source of the disproportionately poorer performance for So sentences. Although Feier's data can be explained by a temporal strategy, which interacts with a parallel function strategy, Feier offered another explanation for her results. She argued that the temporal strategy alone could account for the order of relative clause sentence processing difficulty.

Feier made several points. First, in Ss sentences, the only unspecified function is the subject of the main clause. If the listener selects N1 he will be correct while if he elects N2 he will be incorrect. That very error would yield a correct response for an Os sentence. Second, in the enactment of Oo sentences, only the object of the subordinate clause remains unspecified. If the listener chooses N2, he will be correct, while selection of N1 will result in an incorrect response. Third, in Os sentences, the unspecified

function is the subject of the subordinate clause, which will be correct if N2 is acted out, but incorrect if N1 is opted for. That error would yield a correct response for an Ss sentence. Thus, Feier noted that a trading relation exists between the error strategies on Os and Ss sentences. Finally, for So sentences there exists a conflict between Principles 2 and 3. Under Principle 2, the only unspecified function is the subject of the main clause. If N1 is selected, the listener will be correct, while the election of N2 will lead to an incorrect response. Under Principle 3, a parallel function error is unavoidable in the subject and object of the first enactment, a strategy which leads to correct enactments of the other three sentence types. The subject of the main clause remains unspecified as before, so that if the listener selects N1 as the subject, he will be partly correct, while if he chooses N2, he will have performed both clauses incorrectly (Feier, 1977, pp. 125, 127).

In summary, Feier argued that a temporal strategy better accounts for a greater proportion of errors produced on relative clause sentences than do the strategies predicted by the interruption hypothesis, the parallel function hypothesis or the canonical-sentoid hypothesis. While Feier's speculations are interesting and may be operative for elderly adults, it is difficult to draw firm conclusions as there have been so few studies examining sentence processing in this population.

Exact comparisons between the adult studies reported by Feier (1977) and by Sheldon (1977) are difficult to make because task differences may represent a confounding variable. However, an analysis of their postulated strategies reveals that Feier's temporal strategy and Sheldon's adjacency strategy are essentially similar in nature. Both appear to be temporal strategies. Moreover, the conclusions reached by Wallach for her normal 8-13 year olds, by Feier, and by Sheldon (1977) in her adult study are not qualitatively different. In essence, they all argue that a temporal strategy best accounts for processing difficulty associated with relative clause sentence types under consideration. Of course, the temporal strategy examined in Wallach's study is of a more general nature than that proposed by Feier or Sheldon. Whether or not Wallach's data could be explained by Feier or Sheldon's versions, remains an open issue, since the data were not analyzed in the same way.

Summary

The study of sentence processing has been stimulated by an interest to gain insight into the natural capacity for language in human beings and the psychological processes by which human organisms acquire, comprehend, and generate sentences. The importance of investigating sentence processing in both adults and children has been highlighted in the cognitive and psycholinguistic literature. Much of this research has focused on comprehension strategies, since

they represent the psychological operations used by adults to interpret incoming sentences; moreover, the development and use of comprehension strategies by children appears to be critical to the development of an adult grammar. This Chapter has reviewed and integrated literature which: examined hypotheses about how adults and children comprehend language; identified strategies used to interpret sentences; and determined which aspects of sentences are responsible for variations in level of comprehension difficulty. It is apparent that both adults and children employ different strategies for handling different types of linguistic constructions. Furthermore, the relative reliance on various strategies seems to change over the course of development.

Since language acquisition is largely dependent upon the speech a child hears in his environment, consideration was given regarding the possible facilitative effects of primary linguistic data on the language learner. However, the preponderance of a naturalistic observation methodology has yielded little information about the precise nature of the language learning mechanism. Yet it is of interest to consider to what extent specific manipulations of linguistic input can serve to aid or accelerate the language learning process.

While the study of child language development itself is a fascinating area, it cannot be clearly understood without considering its relation to the child's overall cognitive development. Therefore, studies were presented which

explored the interplay between language acquisition and conceptual development. The specific research discussed in this Chapter focused on experiments which utilized direct intervention in an attempt to clarify this interplay. Although these studies yielded conflicting conclusions, it appears that intervention is a viable methodology for exploring the constraints of cognitive development on language acquisitions.

The Present Research

The main goals of this research are two-fold;

(1) to determine whether direct intervention can accelerate the young child's development of language comprehension abilities by teaching a strategy (or set of strategies) for understanding four types of relative clause sentences.

(2) to identify heuristic strategies used by subjects in attempting to understand those sentences and to compare the subjects' use of strategies with three competing hypotheses of sentence processing.

To fulfill these goals, an experiment was undertaken which involved the development and comparison of two experimental training procedures and one control procedure. The procedures were designed to investigate an operating principle proposed by Slobin (1973). The operating principle states: "Avoid interruption and rearrangement of linguistic units" (p. 199).

The target structures for training were relative clause

sentences. Several factors influenced their selection. The relative clause is a common linguistic structure; it exists as a substantive universal (Bach, 1968). Further, such stimuli have aroused the interest of psycholinguists for good reason; sentences with relative clauses, and in particular, self-embedded relative clause sentences are sometimes difficult to comprehend for adults, as well as for children (Miller and Chomsky, 1963; Miller and Isard, 1964; Stolz, 1967; Foss and Lynch, 1969; Hakes and Foss, 1970; Brown, 1973, etc.). Moreover, there is quite a bit known about the comprehension strategies used by the language learning child in attempting to interpret such structures. Some information also exists regarding when sentences containing relative clauses are naturally acquired in childhood (Limber, 1973; Sheldon, 1974; Brown, 1973). The selection of this structure also permits a replication of Sheldon's (1974) findings with young normal children involving the role of parallel function in the acquisition of relative clauses. In light of more recent research, comparisons can also be made with studies assessing the language organizational abilities of older children (Wallach, 1977) and those of adults of varying age (Feier, 1977; Sheldon, 1977). Finally, the use of the relative clause structure permits a re-examination of three hypotheses which make different predictions about the way sentences containing relative clauses are processed.

CHAPTER III

RESEARCH DESIGN

Introduction

This study was designed to teach young children to develop strategies for understanding complex sentences. The research paradigm for this study consisted of three phases: the Pretest Phase, the Intervention Phase, and the Posttest Phase. The linguistic material used in this study consisted of two types of complex sentences, namely singly embedded relative clause constructions and infinitival complement constructions. The task in each phase involved the child's manipulation of toy objects in response to sentences presented by the experimenter. Each child was tested individually in all phases of the experiment.

The organization of this Chapter will take the following form: The three experimental phases will be outlined, followed by a description of the linguistic materials and toy objects used in this study. Next, the Pretest Phase will be discussed in detail and subject selection will be described. The Intervention Phase and the Posttest Phase will constitute the two subsequent sections. Next, scoring procedures will be presented. The final section of this Chapter addresses the major hypotheses of the present research.

Overview of the Three Experimental Phases

The Pretest Phase, which served as a screening procedure for the selection of subjects, involved a warmup procedure and two testing measures. The two measures were the Complex Sentence Comprehension Test, which was designed specifically for this study, and the Receptive portion of the Northwestern Syntax Screening Test (NSST) (Lee, 1969). The Intervention Phase consisted of three training conditions: the Explicit Training Condition (Condition I), the Implicit Training Condition (Condition II), and the Control Condition (Condition III). The Posttest Phase involved readministrations of the Complex Sentence Comprehension Test. The calendar provided in Appendix A gives the time layout of the study.

Linguistic Material

Two types of complex sentences were selected for examination in this study. These consisted of: (1) sentences containing relative clauses and (2) sentences containing infinitival complements.

1. Relative Clause Constructions

The rationale for selection of relative clause structures was provided in Chapter II. Four types of singly embedded relative clause sentences were examined: subject-subject relatives, subject-object relatives, object-object relatives, and object-subject relatives. In accordance with Sheldon's

(1974) design, half of the sentences in each phase are self-embedded (subject) relatives (Ss, So) and half of the sentences are right-branching (object) relatives (Oo, Os). The relativized noun phrase is either the subject of the clause (Ss, Os) or it is the object of the clause (So, Oo). One half of the sentences in each phase are parallel function relatives; that is, the shared nominals are both subjects (Ss) or both objects (Oo). Half of the sentences are nonparallel function sentences; that is, the co-referential NP's have different grammatical functions in their respective clauses (So, Os). Examples of the relative clause sentences used in this study are shown below.

(3-1) (subject) (subject)
Ss The Turtle that chases the dog slaps the pig.

(3-2) (subject) (object)
So The duck that the pig slaps chases the frog.

(3-3) (object) (object)
Oo The pig slaps the duck that the mouse chases.

(3-4) (object) (object)
Os The dog chases the pig that sits on the duck.

Relative clause constructions were assessed in the Pre-and Posttest Phases. In addition, they comprised the stimulus constructions for the Intervention Phase.

2. Infinitival Complement (For/To) Constructions

In an effort to extend the notion of teaching children to

develop strategies for understanding complex sentences, another complex structure was examined. Two types of for/to sentences adapted from those used by Cromer (1970) were selected for study. The sentence labels, F/T // and F/T X are abbreviations of the sentence type followed by its assigned designation with regard to the parallel function notion. Half of the sentences are parallel function for/to constructions (F/T//); that is, the shared nominal has the same grammatical function in both clauses. In sentence (3-5) for example, it is the wolf who is doing the biting.

(3-5) // The wolf is happy to bite the pig.

(3-6) X The wolf is happy for the pig to bite.

Half of the sentences are nonparallel function for/to constructions (F/T X); that is, the shared nominals have different grammatical functions in their respective clauses, as in sentence (3-6), where it is someone other than the wolf who is doing the biting.

The for/to sentences were assessed during the Pre- and Posttest Phases of the experiment but were not included in the Intervention Phase. This procedure was followed in order to determine whether or not any strategies that the children developed for understanding relative clause sentences would be extended to another complex sentence type.

3. Conjoined Constructions

Conjoined constructions are complex sentences which

contain two or more verbs in the underlying representation. The clauses are joined together by conjunctions as in the example "The cow jumped over the moon and the dish ran away with the spoon" (Jacobs and Rosenbaum, 1968). Conjoined sentences containing two clauses were the stimulus constructions used in Condition III (Control Condition) in the Intervention Phase. They were not assessed in the Pre- and Posttest Phases. Examples of the types of conjoined constructions are shown below.

(3-7) (transitive) (intransitive)

T-I The lion bites the hen and the lamb shakes.

(3-8) (intransitive) (transitive)

I-T The donkey skips and the lamb hits the giraffe.

Toy Materials

The materials for all phases of the experiment consisted of familiar toy animals and toy people. The toys were constructed so that all the limbs were easily moveable enabling the child to manipulate the objects with ease. In addition, the toy objects were proportionally scaled in size to one another; for example, the giraffe was taller than the duck.

Pretest Phase

1. Warmup Procedure

A warmup procedure was used to ensure that a child was

able to perform the experimental task. For this procedure, the child was provided with toy materials and was asked to act out a series of eight sentences presented by the examiner, in the following order:

(1) Two simple sentences referring to two toys and one action (e.g. The dog kicks the lion).

(2) Two sentences referring to two toys and two actions (e.g. The dog kicks the lion and the dog chases the lion).

(3) Three sentences referring to three toys and two actions (e.g. The dog kicks the lion and the lion chases the frog).

The criteria that were established for passing the warmup procedure were: (1) willingness to manipulate toy objects; (2) ability to perform the actions described by the verbs; (3) ability to act out the verbs in a manner that was discernible to the examiner; and (4) ability to manipulate three objects and perform two actions contained in one sentence.

2. Complex Sentence Comprehension Test

The Comprehension Test consisted of 20 sentences, namely, three examples of each of the four types of relatives and four examples of each of the two types of for/to sentences (Appendix B). Sentences ranged in length from eight-ten words. The sentences were randomized and presented in two blocks, each of which contained ten sentences. After each

block, the child received a short break. The test procedure involved telling the children that they were going to play a game in which they had to make the animals and the people do what the experimenter said, making sure to listen carefully and perform the actions in both clauses. The experimenter first asked the child to identify each of the toy objects and to demonstrate the six different actions that the child would have to perform. This activity was conducted to verify that the child was familiar with the toy objects and to ensure that the child's manipulations were clear and distinct from one another. The nouns and verbs used in the Complex Sentence Comprehension Test are shown in Appendix B.

Before each presentation, the examiner placed the three target toy objects on the table in front of the child, one at a time and stated, for example, "Now we are going to play with the dog and the frog and the turtle." The test sentence was then presented to the child. A second presentation was provided if necessary. The experimenter and the child sat on opposite sides of a table throughout all phases of the experiment.

3. NSST

The Receptive portion of the NSST (Lee, 1969) was administered after completion of the Complex Sentence Comprehension Test. The NSST was used in an effort to demonstrate that the children's language performance was equivalent on a commonly used independent standardized

measure of language comprehension.

Subjects

On the basis of the children's performance on Pretest procedures, 18 subjects, ranging in age from 3 years, 6 months to 4 years, 6 months, were selected for study.[1] Nine were male and nine were female. The subjects attended the South Shore Country Day School, Long Island, New York. All subjects were native English speakers with no handicapping conditions.[2]

Each of the 18 subjects was assigned to one of three groups, yielding six subjects per group. The groups were matched for the following variables: (1) pretest score on the relative clause sentences of the Complex Sentence Comprehension Test; (2) distribution of relative clause scores within and between groups; (3) age; and (4) sex. Appendix C compares the makeup of the three groups according to the variables stated above. Each group was randomly assigned to one of the following training conditions:

---

[1]To determine the appropriate age range of subjects for this study, a pilot procedure was conducted which required children to act out relative clause sentences containing two propositions. The pilot data indicated that even after extensive training, children younger than 3 years, 6 months were unable to complete the task.

[2]Health records, parent surveys, and statements from teachers revealed that the subjects were free from physical handicap and language, speech, and hearing problems.

Condition I, Condition II, or Condition III.

Intervention Phase

This Phase of the study involved three training sessions. A set of eight sentences was developed for each session for a total of three sets or 24 sentences. Each set contained different sentences.

In an attempt to increase and maintain the child's interest in the training task, a theme was selected for each set of sentences presented in a training session. The objects used in the sentences coincided with the theme. The following themes were used:

Training Session 1 - Animal Farm

Training Session 2 - The Circus

Training Session 3 - The Zoo

For all three Conditions, the general sequence of events remained the same. First, the child listened to the examiner's presentation of a sentence. Then the child watched as the examiner acted out the same sentence with the target objects. Finally, the child was instructed to enact the same sentence.

The same sets of training sentences, all singly embedded relative clause constructions, were used in Conditions I and II. The relative clause sentences which were created for the Intervention Phase were different from the set developed for the Pre- and Posttest Phases of the study. Each of the three

sets of training sentences were constructed from an exclusive pool of three verbs and six animate objects. The nouns and the verbs used in each training set are shown in Appendix B. The actions in each sentence to be performed with the toys were maximally different to prevent ambiguity; an example is, "The horse stands on the elephant that the owl kicks."

1. Condition I - Explicit Training Condition

During each of the three training sessions, a child received two examples of each of the four types of relatives (or eight sentences). The three sets of training sentences for this Condition are listed in their order of presentation in Appendix B.

For Condition I, a teaching procedure was developed to indirectly exploit Slobin's (1974) Operating Principle D; the language input was structured to avoid interruption of related linguistic elements. For example, the noninterrupted version of sentence (3-9) is sentence (3-10).

(3-9) The lion that falls on the squirrel hits the hen.

(3-10) The lion falls on the squirrel and the lion hits the hen.

Following the examiner's verbal presentation and actual enactment of the relative clause sentence in its surface form as in (3-9), the examiner verbally separated the matrix clause from the embedded clause, as in (3-10), to show the child the way in which discontinuous (noninterrupted)

elements are combined to form continuous (interrupted) elements.

The specific training sequence involved the following steps after the three toy objects were placed on the table:

(1) The examiner verbally presented the target relative sentence in its surface form and then enacted the sentence with the toy objects.

(2) The examiner verbally gave the noninterrupted version of the sentence, enacting each clause directly following the verbal presentation.

(3) Same as Step (1).

(4) Same as Step (1).

(5) The child acted out the target sentence with the same toy objects.

Instructions for Condition I are shown in Appendix D.

2. Condition II - Implicit Training Condition

During each of the three training sessions, a child received the same two examples of each of the four types of relatives (or eight sentences) as in Condition I. The three sets of training sentences for this Condition are listed in their order of presentation in Appendix B.

In contrast to Condition I, Condition II was designed to rely solely on the child's natural inductive capacities for acquiring language. A teaching procedure was developed in which the child was exposed to examples of sentences containing relative clauses. In this Condition, the

linguistic input was presented only in its surface form and was not manipulated or structured by noninterruption. For example, the child heard surface forms such as "The horse stands on the elephant that the owl kicks." The specific training sequence involved the following steps after the three toy objects were placed on the table:

(1) The examiner verbally presented the target relative sentence in its surface form and then enacted the sentence with the toy objects.

(2) Same as Step (1).

(3) The examiner verbally presented the same target relative clause sentence.

(4) Same as Step (3).

(5) The child acted out the target sentence with the same toy objects.

Instructions for Condition II are shown in Appendix D.

3. Condition III - Control Condition

During each of the three training sessions, each child received a set of eight conjoined sentences. Due to the nature of the conjoined constructions used in this study, each sentence contained one intransitive verb and one transitive verb. A pool of three familiar intransitive verbs were used in each of the three sets of training sentences, for a total of nine intransitive verbs. A list of the intransitive verbs are shown in Appendix B. The three sets of conjoined sentences for this Condition are listed in their

order of presentation, also in Appendix B.

Condition III was designed as a control condition to rule out the possibility that performance in the Posttest Phase would be attributed to factors other than training. Such factors included sentence length, the child's ability to act out two propositions, and the time span between the Pretest and the Posttest Phases. In this Condition, each subject was trained to act out the conjoined sentences using the same procedure as that described for Condition II. Instructions for Condition III are shown in Appendix D.

4. Additional Information for Conditions I, II, and III

In each training session, the set of eight sentences was presented in two blocks of four sentences each. After the first block, the child received a short break. Each training session lasted approximately 15 minutes.

In addition, the order in which sentence types were presented was changed across training sessions. This manipulation was designed to control for a learning pattern effect attributed to factors such as order of sentence presentation or attention span. In an attempt to develop an efficient and effective teaching procedure, and to minimize confusion for the child, sentences of the same construction type were presented in contiguous order. For example, the two Oo training sentences were presented followed by the two So sentences.

Posttest Phase

This Phase of the study consisted of readministration of the Complex Sentence Comprehension Test to all 18 subjects on two separate occasions: (1) shortly after termination of the final training session and (2) following a two week period of no intervention. The purpose of Posttest 1 was to demonstrate the acquisition of a new behavior. The purpose of Posttest 2 was to assess maintenance of the new behavior or any change in behavior. Each administration of the Posttest lasted approximately 20 minutes.

Scoring

Identical scoring criteria were used in all phases of the experiment. A correct response was defined as an accurate enactment of both clauses in a sentence in either order. All other responses were considered incorrect. To examine each subject's performances in detail, an exact description of the child's responses (i.e. enactments) was recorded in narrative form. A sample copy of the Recording Form used in the Pre - and Posttest Phases is shown in Appendix E, as is a sample copy of the Recording Form used in the Intervention Phase.

Major Hypotheses

Two major hypotheses were tested:

(1) Young children can be trained to understand singly embedded relative clause sentences at an accelerated rate.

(2) Explicit Training (Condition I) will be a more effective intervention procedure than Implicit Training (Condition II). Furthermore, it is predicted that either Conditions I or II training will be more effective than the Control Condition (Condition III).

To motivate the second hypothesis, the underlying assumption is that the two experimental training procedures (Conditions I and II) will differentially affect learning and will thus indirectly test one of Slobin's (1974) principles of language acquisition. A training procedure specifically designed to help a child handle or circumvent interrupted segments in singly embedded relative clause sentences (Condition I) is expected to be a more effective teaching method in facilitating comprehension than one which relies solely on a child's natural inductive capacities (Condition II).

To test these hypotheses the data were subjected to quantitative analysis. The statistical design and results will be presented in Chapter IV. In addition, qualitative analyses performed on the error data will be presented.

CHAPTER IV

RESULTS

The results of this study will be reported in four major sections: (1) quantitative analysis of performance on the relative clause sentences; (2) qualitative analysis of performance on relative clause sentences during the Intervention Phase; (3) quantitative analysis of performance on the for/to sentences; and (4) qualitative analysis of performance on relative clause constructions at the Pre- and Posttest Phases. In this fourth section, error responses on the four types of relative clause sentences will be reported and classified according to the types of heuristic strategies employed by the subjects to interpret these constructions.

Relative Clause Sentences

The relative clause sentence data were analyzed with a 3 x 2 x 2 x 3 (TESTING PERIOD X PARALLEL FUNCTION/NONPARALLEL FUNCTION X OBJECT RELATIVE/SUBJECT RELATIVE X TRAINING CONDITION)[1] analysis of variance. All factors were within-subjects variables, except for the final factor, which was a between-subjects variable. The PERIOD factor was defined by three levels, Pretest, Posttest 1, and Posttest 2;

---

[1]These factors will be referred to hereafter as: PERIOD, PARALLEL/NONPARALLEL, OBJECT/SUBJECT, and CONDITION, respectively.

the PARALLEL/NONPARALLEL and the OBJECT/SUBJECT factors were defined by two levels; and the CONDITION factor was defined by three levels, Explicit Training (I), Implicit Training (II), and Control (III). For significant interactions and main effects, simple effects analyses were performed to further delineate sources of significance by orthogonal weighting coefficients (Edwards, 1950).

The form of the raw data for the relative clause sentences was expressed as the proportion:

$$\frac{\text{Total Number Sentences Correct}}{\text{Total Number Sentences Possible}}$$

This proportional value was calculated by subject for each level of each factor. For any single cell, the total possible number of correct sentences was 3. (Recall that there were three examples of each sentence type that were scored.) Arcsine transformations were applied to the raw proportion data and yielded the same main effects and interactions as for the analyses of variance on nontransformed scores. Results of the analysis of variance reported below are based on the nontransformed scores.

The group means and standard deviations of the relative clause sentence data are presented in Table 4-1, and the individual data in Appendix F. A summary of the results for the main effects and interactions is provided in Table 4-2.

One of the most interesting results of this study was the significant interaction between PERIOD and CONDITION, $F(4,20)=3.964; p < .02$ (Figure 4-1, Table 4-3) which

TABLE 4-1

MEANS AND STANDARD DEVIATIONS OF PROPORTION SCORES ON RELATIVE CLAUSE SENTENCES (PF = PARALLEL FUNCTION, NPF = NONPARALLEL FUNCTION, O = OBJECT RELATIVE, S = SUBJECT RELATIVE)

	Testing Period											
Condition	Pretest				Posttest 1				Posttest 2			
	PF		NPF		PF		NPF		PF		NPF	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
I O	.1111	.1721	.2222	.2722	.4444	.3443	.4444	.2722	.4445	.3443	.7778	.2722
S	.2778	.3277	.0555	.1361	.3889	.3897	.5000	.1826	.5556	.3443	.3889	.3277
II O	.1111	.1721	.2222	.2722	.5555	.4037	.5555	.4037	.6111	.3277	.6667	.2981
S	.3333	.0000	.0000	.0000	.4444	.2722	.1667	.2789	.6111	.2509	.3889	.2509
III O	.0555	.1361	.1667	.2789	.1666	.1825	.2778	.2509	.1666	.1825	.1666	.1825
S	.2778	.3897	.1111	.1721	.4444	.1722	.0000	.0000	.5555	.2722	.1111	.1721

TABLE 4 - 2

SUMMARY TABLE FOR THE TESTING PERIOD (PERIOD) X PARALLEL FUNCTION/NONPARALLEL FUNCTION (PF/NPF) X OBJECT RELATIVE/SUBJECT RELATIVE (O/S) X TRAINING CONDITION (CONDITION) ANALYSIS OF VARIANCE ON PROPORTION SCORES FOR RELATIVE CLAUSE SENTENCES

Source of Variance	SS	df	MS	F	p
O/S	0.05144	1	0.05144	1.126	.302
PF/NPF	0.29629	1	0.29629	6.485	.018*
Period	3.22334	2	1.61167	35.278	.001***
Condition	1.52582	2	0.76291	16.699	.001***
O/S X PF/NPF	1.50004	1	1.50004	32.834	.001***
O/S X Period	0.11212	2	0.05606	1.227	.314
PF/NPF X Period	0.00309	2	0.00154	0.034	.967
O/S X Condition	0.41462	2	0.20731	4.538	.023*
PF/NPF X Condition	0.28700	2	0.14350	3.141	.069
Period X Condition	0.72434	4	0.18109	3.964	.016*
OS X PF/NPF X Period	0.06482	2	0.03241	0.709	.508
OS X PF/NPF X Condition	0.07715	2	0.03857	0.844	.552
OS X Period X Condition	0.23664	4	0.05916	1.295	.305
PF/NPF X Period X Condition	0.19135	4	0.04784	1.047	.409
O/S X PF/NPF X Period X Condition	0.32097	4	0.08024	1.756	.177
O/S X PF/NPF X Period X Condition X Subjects Within Groups	0.91371	20	0.04569		

*p < .05

**p < .01

***p < .001

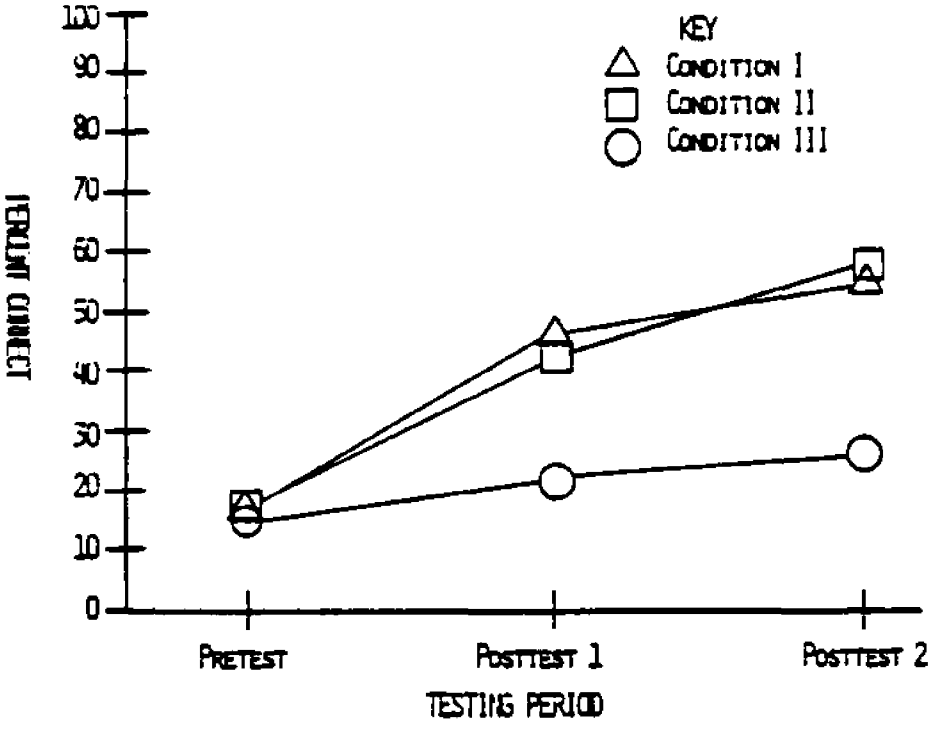


Figure 4-1. Mean values of proportion scores for relative clause sentences according to testing period and condition.

TABLE 4-3

MEAN PROPORTION SCORES FOR RELATIVE CLAUSE SENTENCES ACCORDING TO TRAINING CONDITION AND TESTING PERIOD

	Testing Period		
Condition	Pretest	Posttest 1	Posttest 2
I	.1667	.4444	.5417
II	.1667	.4306	.5694
III	.1528	.2222	.2500

demonstrated that direct intervention facilitated children's comprehension of the relative clause sentence types used in this study. To understand the relation between the PERIOD and the CONDITION factors the data were inspected in two ways.

The first examined the effect of Testing Period on each of the three Conditions. It is evident that while scores for subjects in Conditions I and II greatly increased between the Pretest Phase and the Posttest Phase, scores for subjects in Condition III did not. Specifically, means comparisons indicated a significant increase in scores between the Pretest and Posttest 1 Periods for both Condition I, $F(1,20) = 5.06$; $p < .05$, and Condition II, $F(1,20) = 4.57$; $p < .05$. No significant difference between these two testing periods was demonstrated for Condition III. Means comparisons further indicated no significant difference in relative clause scores between the Posttest 1 and Posttest 2 Periods for subjects in Conditions I, II, and III.

While the statistical comparisons show that subjects' level of performance on relative clause sentences was essentially maintained, an inspection of the group means for Conditions I and II subjects shows higher scores in the Posttest 2 Period than in the Posttest 1 Period. These higher scores achieved by subjects in Conditions I and II in the Posttest 2 Period are clearly reflected in the probability levels for the F scores in the following comparisons. That is, means comparisons revealed significantly higher scores in the Posttest 2 Period than in

the Pretest Period for both Condition I, $F(1,20)=9.23;p < .01$, and Condition II, $F(1,20)=10.645;p < .01$. No significant difference was found for Condition III between the Pretest and Posttest 2 Periods.

This solid improvement in performance for subjects in Conditions I and II in the Posttest 2 Period compared to the Pretest Period confirms the effectiveness of the two experimental training procedures over time. The implications of this finding will be discussed in Chapter V.

The robust effect of intervention is demonstrated by the fact that there was a significant main effect found for the PERIOD factor independent of Training Condition, $F(2,20)=35.278;p < .001$. A breakdown of this effect revealed significantly higher scores in the Posttest 1 Period than in the Pretest Period, $F(1,20)=8.172;p < .01$, as well as significantly higher scores in the Posttest 2 Period than in the Pretest Period, $F(1,20)=16.757;p < .01$. No significant difference in scores was found between the two Posttest Periods. While one certainly cannot ignore the interaction between PERIOD and CONDITION, this main effect suggests that the increase in score at the Posttest 1 Period was so great for Conditions I and II, that even when pooled with Condition III, it yielded a statistically significant improvement.

One might also consider the significant main effect for CONDITION. None of the multiple comparisons were significant. However, the main effect must be viewed in light of the significant interaction between CONDITION and

PERIOD. That is, the effect of different Training Conditions is most meaningful when considered in relation to Testing Period described in detail above.

The second way to describe the PERIOD X CONDITION interaction is to compare subject performance across Conditions for each Testing Period. For the Pretest Period, scores were essentially the same between Conditions I and II, II and III, and I and III. At the Posttest 1 Period, the mean scores for Condition I and for Condition II were definitely higher than for Condition III, although these scores did not reach a significantly higher level until the Posttest 2 Period. Specifically, for the comparison between Condition I and III, $F(1,20)=5.586; p < .05$, and between Conditions II and III, $F(1,20)=6.70; p < .05$ at the Posttest 2 Period. No significant difference was found between Conditions I and II at the Posttest 2 Period. Thus, the effectiveness of the two experimental training procedures was most evident at the Posttest 2 Period. Furthermore, the comparisons show that the two experimental Training Conditions (Explicit and Implicit) were not differentially effective in teaching children to understand singly embedded relative clause sentences.

Another interesting result of this study centers around the OBJECT/SUBJECT and PARALLEL/NONPARALLEL factors. The main effect for the OBJECT/SUBJECT factor was not statistically significant, indicating no reliable differences in scores on the basis of embedding. That is, performance on

SE sentences (Ss and So, combined) was essentially the same as that on RB sentences (Os and Oo, combined). A separate F-ratio was derived to contrast word order in the relative clause in which either the subject NP is relativized (Ss and Os, combined) or the object NP is relativized (So and Oo, combined). This main effect was certainly significant, $F(1,20)=32.830; p < .001$. These data lend support to the canonical-sentoid hypothesis, while no support is found for the interruption hypothesis.

A significant main effect was shown for PARALLEL/NON-PARALLEL, $F(1,20)=6.485; p < .02$, in that performance on parallel sentences was better than on nonparallel sentences. This finding is only of interest in relation to the significant interaction between PARALLEL/NONPARALLEL and OBJECT/SUBJECT factors, $F(1,20)=32.834; p < .001$, (Table 4-4). While scores for parallel function sentences were lower for object relatives (Oo) than for subject relatives (Ss), scores for nonparallel function sentences were significantly higher for object relatives (Os) than for subject relatives (So), $F(1,20)=7.682; p < .05$. This pattern was the same for all Conditions, an expected result based on the fact that the three-way interaction between the CONDITION, PARALLEL/NONPARALLEL, and OBJECT/SUBJECT factors was not significant. This interaction suggests that the effect of relative clause sentence type is inversely related to parallelity. In other words, in object relative clauses, scores on parallel function sentences were lower than scores

TABLE 4-4

MEAN PROPORTION SCORES FOR RELATIVE CLAUSE SENTENCES ACCORDING TO PARALLEL FUNCTION/NONPARALLEL FUNCTION (PARALLEL/NONPARALLEL) AND OBJECT RELATIVE/SUBJECT RELATIVE (OBJECT/SUBJECT)

	Object	Subject
Parallel	.2963 (Oo)	.4321 (Ss)
Nonparallel	.3889 (Os)	.1914 (So)

on nonparallel function sentences, but in subject relatives, scores were significantly higher, $F(1,20)=11.410; p < .01$, in parallel function sentences than in nonparallel function sentences.

When viewed from the order of difficulty among sentence types, the data show that the children demonstrated significantly higher scores on both the Ss and Os relatives, the subject relatives with subject focus and the object relatives with subject focus, respectively, than on the So relatives. There were no statistically significant differences between the other sentence types. The subject relatives with object focus, the So sentences, were most difficult for all subjects. Thus, the hierarchy from easiest to most difficult sentence type was Ss>Os>Oo>So, pooled across Training Conditions and Testing Periods.

These results are indicative of a different pattern than demonstrated by those subjects in Sheldon's (1974) study who were of a comparable age range to those in the present investigation. It could also be noted at this time that the pattern of sentence difficulty found in the present study differed from the pattern found in Wallach's (1977) data on normal 8 to 13 year olds and in Feier's (1977) and Sheldon's (1977) data on adults. Implications of these cross-study comparisons will be presented in Chapter V.

Moreover, the nonsignificant OBJECT/SUBJECT X PARALLEL/NONPARALLEL X PERIOD interaction showed improved performance on the relative clause sentences, but did <u>not</u>

show alteration in the hierarchy of difficulty. This is exemplified by the nonsignificant interaction between the OBJECT/SUBJECT, PARALLEL/NONPARALLEL, and PERIOD factors.

Furthermore, this hierarchy was essentially consistent across Training Conditions, as well. The four-way interaction, OBJECT/SUBJECT X PARALLEL/NONPARALLEL X PERIOD X CONDITION, was not significant. These data indicate that the training procedures used in this study did not differentially affect the subjects' pattern of performance; the fact that the heuristic strategy (or set of strategies) employed by the children remained virtually the same across all three Training Conditions suggests that general processing strategies are independent of training over time.

Although the OBJECT/SUBJECT X CONDITION interaction was significant, $F(2,20)=4.538; p < .03$, this finding is not particularly interesting in light of the interaction of the OBJECT/SUBJECT factor with the PARALLEL/NONPARALLEL factor described above.

At this point, it is of value to summarize the major results reported thus far. Subjects in Conditions I and II demonstrated a significant improvement in performance on relative clause sentence types over time, while subjects in Condition III did not. This learning effect was clearly evidenced by the first Posttest Period and increased further by the second Posttest Period. No significant differences in learning were found between the two experimental Conditions.

In addition, the role of embedding as assessed by the

main effect for the OBJECT/SUBJECT factor was not significant. On the other hand, word order did prove to be a significant factor. Furthermore, the role of PARALLEL FUNCTION and OBJECT/SUBJECT factors significantly interacted. For object relative clauses, scores on parallel function sentences were lower than for nonparallel function sentences; but, in subject relatives, scores on parallel function sentences were significantly higher than on nonparallel function sentences. This effect held true across Conditions and suggests that the parallel function hypothesis could not alone account for the children's performance.

The relative clause data at the Pretest, Posttest 1, and Posttest 2 Periods have been quantitatively assessed and reported above. The performance of subjects in the three Conditions during the actual Intervention Phase will now be presented.

Intervention Phase: Training Sessions

This section reports and compares the performance of children in Conditions I and II in the Intervention Phase of the study. An individual score represents the total possible number of correct responses (i.e. 2) on each of the four relative clause sentence types for each child in a Condition for each sentence type as well as for sentence types combined. The group total score refers to the total number of correct responses for each sentence type and for sentence types combined summed across all children in a Condition.

The group mean score represents the mean number of correct responses for each sentence type and for sentence types combined for all children in a Condition.

For Condition I (Table 4-5), in training sessions 1 and 3, the group mean scores for each sentence type, from highest to lowest, yielded essentially the same hierarchy of difficulty, Oo > Ss > Os > So. (In training session 3, mean scores for Oo and Ss sentences were actually equal.) In training session 2, however, the group mean scores for each sentence type yielded a different pattern of performance, the hierarchy being Os > Oo > Ss=So.

For Condition II (Table 4-6), in training sessions 1 and 3, the group mean scores for each sentence type, from highest to lowest, yielded the same hierarchy of difficulty, Ss > Oo > Os > So. In the second training session, however, the group mean scores for each sentence type resulted in a different performance pattern, Ss=So > Oo=Os.

Several comments can be made about these intervention data. A comparison of the data displayed in Tables 4-5 and 4-6 shows different performance patterns <u>within</u> a Condition across the three training sessions. Performance patterns also differed <u>across</u> Conditions within a training session. Moreover, the relative order of difficulty of the four sentence types in all three training sessions for both Conditions I and II differed from that found on the Pre- and Posttest Phases. (Recall that mean scores yielded the same hierarchy in all three Testing Periods, Ss > Os > Oo > So).

TABLE 4 - 5

SCORES ON RELATIVE CLAUSE SENTENCES FOR CONDITION I IN THE INTERVENTION PHASE

Training Session	Subjects	Sentence Type Oo	Ss	Os	So	Sentence Types Combined
	1	2	0	0	0	2
	2	2	1	0	1	4
	3	1	0	0	0	1
1	4	1	2	0	0	3
	5	2	1	2	0	5
	6	2	2	1	0	5
	Group Total	10	6	3	1	20
	Group $\bar{X}$	1.67	1.00	.50	.17	3.33
	1	0	0	0	1	1
	2	0	0	1	0	1
	3	1	1	1	0	3
2	4	2	2	2	0	6
	5	2	1	2	2	7
	6	2	1	2	2	7
	Group Total	7	5	8	5	25
	Group $\bar{X}$	1.17	.83	1.33	.83	4.17
	1	1	0	0	0	1
	2	2	2	1	0	5
	3	2	1	1	1	5
3	4	1	2	1	1	5
	5	1	2	1	2	6
	6	2	2	2	1	7
	Group Total	9	9	6	5	29
	Group $\bar{X}$	1.50	1.50	1.00	.83	4.83

TABLE 4 - 6

SCORES ON RELATIVE CLAUSE SENTENCES FOR CONDITION II IN THE INTERVENTION PHASE

Training Session	Subjects	Sentence Type Oo	Ss	Os	So	Sentence Types Combined
	1	1	1	2	0	4
	2	2	2	0	0	4
	3	1	1	0	0	2
1	4	2	2	1	2	7
	5	0	2	1	0	3
	6	2	1	2	1	6
	Group Total	8	9	6	3	26
	Group $\bar{X}$	1.33	1.50	1.00	.50	4.33
	1	1	2	2	2	7
	2	1	1	1	1	4
	3	1	1	1	1	4
2	4	2	2	2	2	8
	5	0	1	0	0	1
	6	2	1	1	2	6
	Group Total	7	8	7	8	30
	Group $\bar{X}$	1.17	1.33	1.17	1.33	5.0
	1	1	2	2	1	6
	2	2	2	1	0	5
	3	1	1	1	1	4
3	4	2	2	2	1	7
	5	0	1	0	0	1
	6	2	2	0	1	5
	Group Total	8	10	6	4	28
	Group $\bar{X}$	1.33	1.67	1.00	.67	4.67

Further inspection of the group total scores and the group mean scores for sentence types combined for both Conditions I and II across the three training sessions, indicates that overall improvement was essentially steady and that the magnitude of improvement was similar for both Conditions. In addition, individual and group scores revealed that no one sentence type improved at a faster rate than any other type. For any one training session, individual children seemed to perform quite differently, not following an obvious pattern. Of most interest is the analysis of group scores for sentence types combined, which show that as a group, children improved across training sessions; hence, no further analysis of individual data will be made. Interpretation of the Intervention Phase data reported above will be addressed in Chapter V.

For/To Sentences

The for/to sentence data were analyzed with a 3x2x3 (PERIOD X PARALLEL/NONPARALLEL X GROUP) analysis of variance. The PERIOD factor was defined by three levels, Pretest, Posttest 1, and Posttest 2; the PARALLEL/NONPARALLEL factor was defined by two levels; and the GROUP factor was defined by three levels, G1, G2, and G3. Group 1 was comprised of the six subjects who received Explicit Training (Condition I); Group 2 was comprised of the six subjects who received Implicit Training (Condition II); Group 3 was comprised of the six subjects who were in the Control

Condition (Condition III). For significant main effects, multiple comparison procedures were performed to further delineate sources of significance (Edwards, 1950).

The group means and standard deviations of the for/to sentence data are presented in Table 4-7, and the individual subject data in Appendix F. The form of the raw data for the for/to sentences was expressed as total number correct. For any single cell, the total possible number of correct sentences was 4. (Recall that there were four examples of each sentence type that were scored). A summary of the results of the analysis of variance is provided in Table 4-8. No interactions of the first or second order were significant.

First consider the main effect for PERIOD which revealed a significant F value, $F(2,20)=5.434; p < .02$. Scores pooled across sentence type and Group demonstrated an increase over time. However, means comparisons indicated no significant differences in scores between any two Testing Periods, probably reflective of the exceptionally high scores in the Pretest Phase.

A significant main effect was also found for the PARALLEL/NONPARALLEL factor, $F(1,20)=81.841; p < .001$. Scores averaged across Groups and Period on parallel function sentences were significantly higher than on nonparallel function sentences, $F(1,20)=27.284; p < .01$.

The analysis of variance did not yield a significant

TABLE 4 - 7

MEANS AND STANDARD DEVIATIONS OF SCORES ON FOR/TO SENTENCES
(PF = PARALLEL FUNCTION, NPF = NONPARALLEL FUNCTION)

	Testing Period											
Group	Pretest				Posttest 1				Posttest 2			
	PF		NPF		PF		NPF		PF		NPF	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
1	3.3333	1.2111	2.8333	1.1690	4.0000	.0000	2.3333	1.2111	3.8333	.4082	2.1667	1.8348
2	3.5000	.5477	2.0000	.8944	4.0000	.0000	2.8333	1.4720	4.0000	.0000	2.8333	1.1690
3	2.8333	1.1690	2.0000	1.0954	3.8333	.4082	2.3333	1.0328	4.0000	.0000	2.6667	1.2111

TABLE 4 - 8

SUMMARY TABLE FOR THE TESTING PERIOD (PERIOD) X PARALLEL FUNCTION/NONPARALLEL FUNCTION (PF/NPF) X GROUP ANALYSIS OF VARIANCE ON SCORES FOR FOR/TO SENTENCES

Source of Variance	SS	df	MS	F	p
PF/NPF	42.81480	1	42.81480	81.841	.001***
Period	5.68518	2	2.84259	5.434	.013*
Group	1.12963	2	0.56481	1.080	.360
PF/NPF X Period	1.35185	2	0.67593	1.292	.297
PF/NPF X Group	0.01852	2	0.00926	0.018	.983
Period X Group	3.42593	4	0.85648	1.637	.203
PF/NPF X Period X Group	2.31481	4	0.57870	1.106	.381
PF/NPF X Period X Group X Subjects Within Groups	10.46296	20	0.52315		

*p < .05

**p < .01

***p < .001

F-ratio for the GROUP factor when scores were pooled across PARALLEL/NONPARALLEL and PERIOD. In other words, all groups achieved scores that were essentially equivalent.

While G3 had lower scores than G1 and G2 on parallel sentences at almost every Testing Period and the same or lower scores than at least one of the other groups on nonparallel sentences (i.e. never a higher score than both groups on parallel or nonparallel sentences), the differences were not significant. Moreover, the rate of G3's improvement on both parallel and nonparallel sentences was essentially the same as for Groups 1 and 2. Chapter V will further address the issues surrounding the children's performance on the for/to sentences.

In summary, then, the for/to sentence data showed that subjects' scores improved significantly between the Pretest and Posttest Phase. Also, scores on parallel function sentences were higher than on nonparallel function sentences. No significant differences in performance on these sentence types was found between the three groups; all groups improved at virtually equivalent rates over time on the two sentence types.

The final section of this Chapter will examine the incorrect response data from the relative clause sentences. Such an analysis was undertaken, since correct response data seldom yield information about strategies used to interpret sentences. As Lewis Thomas (1979) so eloquently wrote,

> Mistakes are the very base of human thought... If we are not provided with the knack of being wrong, we could never get anything useful done... We are built to make mistakes, coded for error...if it is a lucky day in a lucky laboratory, somebody makes a mistake... then the action can begin... What is needed for progress to be made, is the move based on the error. (p.37-38)

Analysis of Error Data

Table 4-9 presents a distribution of the total number of relative clause errors by Training Condition. Of the 435 errors made, Condition III subjects made the most errors, accounting for 39% of the total errors with a mean of 28.2 errors. The error rates for Conditions I and II were comparable, in that they accounted for 31% and 30% of the total errors, with means of 22.5 and 21.8 errors, respectively. The display also shows some scattering of error rates for subjects within each Condition. For Condition III, the distribution of total errors ranges from 23-32, representing the smallest degree of scatter. In contrast, Condition I's error distribution ranges from 13-31, reflecting the largest scatter. Condition II's range, 16-26, maintains the intermediate position in degree of error rate scatter.

When the total number of errors made according to Condition are analyzed by sentence type, (Table 4-10), it is noted that Condition III made the most errors on all relative sentence types other than Ss. Despite the small differences in error rate between sentence types, for Conditions combined, an analysis of the proportion of errors for each

TABLE 4 - 9

DISTRIBUTION OF RELATIVE CLAUSE ERRORS
ACCORDING TO TRAINING CONDITION

Number of Errors	Condition I	Condition II	Condition III	Conditions Combined
0				
13	1			1
14				
15				
16	1	1		2
17				
18				
19		1		1
20				
21		1		
22				1
23	1	1	1	3
24				
25	1			1
26		2	1	3
27	1			1
28			1	
29			1	1
30				1
31	1		1	2
32			1	1
33				
34				
35				
36				
Total # Errors	135	131	169	435
$\bar{X}$	22.5	21.8	28.2	24.2
%	31	30	39	39

TABLE 4 - 10

TOTAL ERRORS ACCORDING TO SENTENCE TYPE
AND TRAINING CONDITION

Sentence Type	Condition			Conditions Combined	
	I	II	III	Total # Errors	% Errors
Ss	34	27	31	92	.21
Os	31	29	41	101	.23
Oo	35	31	47	113	.26
So	35	44	50	129	.30

sentence type reveals that of all errors made, 21% were made on the Ss sentences, 23% on the Os', 26% on the Oo's and 30% on the So sentences.

As seen in Chapter II, earlier studies predicted certain strategic errors that subjects might make in their attempts to comprehend relative clause sentences. Some of those predicted strategies did indeed account for many of the errors made by the children in this study, but others did not. Table 4-11 illustrates for each sentence type and for each Condition, the total number and proportion of predicted strategic and nonpredicted strategic errors. (For ease of discussion, predicted strategic errors and nonpredicted strategic errors will heretofore be referred to as PS and NPS respectively.) Subjects made more NPS than PS errors; of the 435 errors made in enactment of the four sentence types, the NPS errors accounted for 52.2% of the total number of errors and the PS errors accounted for 47.8%. When sentence types are combined, it is seen that Condition III made more errors of both the PS and NPS types, than either Condition I or II. Most striking is the substantially greater number of errors made by Condition III in the NPS category than those made by Conditions I and II; Condition III subjects made 93 NPS errors in comparison to the 65 and 69 errors made by Conditions I and II, respectively. Further inspection indicates that Condition III made more NPS errors on all four sentence types than did Conditions I and II, whereas Condition II produced more erroneous responses on So and Os

TABLE 4 - 11

TOTAL PREDICTED AND NONPREDICTED ERRORS ACCORDING TO SENTENCE TYPE AND TRAINING CONDITION (I, II, III)

	Sentence Type												Sentence Types Combined							
	SS			Os			Oo			So			Total #				Total %			
Type of Error	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	All	I	II	III	All
Predicted	14	13	6	17	9	15	19	16	27	20	24	28	70	62	76	208	.34	.30	.37	.478
Nonpredicted	20	14	25	14	20	26	16	15	20	15	20	22	65	69	93	227	.29	.30	.41	.522

sentences than Condition I. For the Ss sentences, Condition I made more NPS errors than Condition II, while Conditions I and II yielded essentially the same error rate on the Oo sentences.

The PS errors did not yield as neat a classification. Comparative error rates for the three Conditions differed according to sentence type. For example, while Condition III made the most errors on the Oo and So relatives, Condition I's performance yielded the most incorrect responses on the Os sentences. It should be noted, however, that Condition II held an intermediate position on the So types while their performance on Ss was essentially equivalent with Condition I and was lowest on Os and Oo sentences.

To recapitulate, the most salient information revealed by Table 4-11 is Condition III's performance. This group evidenced the highest error rate for both error categories, although the rate appeared highest for NPS errors. Error responses will subsequently be analyzed separately by predicted strategies and by nonpredicted strategies.

1. Predicted Strategy Errors

PS errors were examined categorically, by First Noun, SVO, parallel function, and extraposition. Clearly, both First Noun and SVO errors represent strategies predicted by the canonical-sentoid hypothesis, the First Noun strategy being the most primitive version of the more sophisticated SVO strategy.

Table 4-12, accordingly, presents the distribution of errors for each predicted strategy by sentence type. The outcome of this distribution reveals that the parallel function strategy accounted for approximately 50% of the error responses. Further, of the parallel function errors made, the most prevalent error was to convert nonparallel sentences to Ss sentences. That is, there was a tendency to interpret Os and So sentences as subject relatives with subject focus rather than to transform them into object relatives with object focus. The predominance of the Ss conversion seems to indicate that the children employed the First Noun strategy in their attempts to comprehend the nonparallel sentences. That is, they interpreted the first heard noun as the subject of both the main and subordinate clauses. Typical examples of the children's error are:

Os
Stimulus Sentence
The lady waves at the fairy/who kisses the witch.
Child's enactment
The lady waves at the fairy; the lady kisses the witch.
So
Stimulus Sentence
The dog/that the mouse chases/sits on the turtle.
Child's enactment
The dog chases the mouse; the dog sits on the turtle.

Moreover, when the error proportions for parallel function are combined with the first noun and SVO errors, the resulting figure shows that 82% of the total PS errors conform to the predictions of the canonical-sentoid hypothesis. The 82% may

TABLE 4 - 12

TOTAL PREDICTED STRATEGIC ERRORS ACCORDING TO SENTENCE TYPE AND STRATEGY TYPE

Strategy	Sentence Type: Total Number Ss	Os	Oo	So	Total Percent Ss	Os	Oo	So	Sentence Types Combined: Total #		Total %	
First Noun	1	1	25	8	.03	.03	.71	.23	35		.17	
SVO	29				1.00				29		.14	
Parallel Oo		7		20		.26		.74	27	105	.13	.51
Parallel Ss		31		47		.40		.60	78		.38	
Extraposition		3	36			.08	.92		39		.19	

be somewhat inflated, since the First Noun strategy category is included in the proportional value. That is, the First Noun strategy can be used on all four sentence types, whereas all other strategies except for SVO are applicable to only two types. One sentence type is vulnerable to SVO. In other words, the First Noun strategy had the opportunity to occur at least twice as frequently as any of the other strategies; in actuality, the percentage of the time that this strategy was employed was essentially equivalent to the SVO, parallel function (Oo) and extraposition strategies. However, this certainly does not appear to affect interpretation of the data since the value 17% (contributed from the First Noun PS category) is inflated by 8.5% at most.

Finally, PS errors were analyzed by sentence type and Condition across Testing Periods to evaluate possible effects of intervention on error patterns. The total number of PS errors displayed in Table 4-13 indicate that on the Pretest, subjects in Condition I made substantially more PS errors than those in Conditions II and III, whose error rates were essentially equivalent. Posttest 1 error rates were similar for all three Conditions, although Condition III made more errors than Conditions I and II. In effect, then, the error rates for II and III increased while the rate for I remained the same. By Posttest 2, the control group, Condition III, demonstrated a further increase in their number of errors, while the error rates for the experimental groups, I and II, remained virtually the same.

TABLE 4 - 13

NUMBER OF PREDICTED STRATEGIC ERRORS ACCORDING TO TRAINING CONDITION, TESTING PERIOD (PRETEST, POSTTEST 1 = PT 1, POSTTEST 2 = PT 2) AND STRATEGY TYPE

Strategy	Condition I			Condition II			Condition III		
	Pretest	PT 1	PT 2	Pretest	PT 1	PT 2	Pretest	PT 1	PT 2
First Noun	7	2	3	4	5	5	1	5	4
SVO	3	6	4	0	6	5	0	4	1
Parallel Oo	1	1	4	2	2	1	4	5	6
Parallel Ss	9	10	9	7	8	9	6	7	13
(Oo + Ss)	(10)	(11)	(13)	(9)	(10)	(10)	(10)	(12)	(19)
Extraposition	4	4	3	2	2	4	5	6	9
Total	24	23	23	15	23	24	16	27	33

More specifically, one can consider strategy pattern changes in PS errors over time for each Condition. Table 4-14 displays the proportionate number of times each strategy was used at each Testing Period for all Conditions. For Condition I, the data highlight a decrease in use of the First Noun strategy (16%) and an increase in the parallel Oo conversion (11%) over the course of the three Testing Periods. For Condition II, it is noted that the reliance on the SVO strategy increased by 21%, while a decrease was demonstrated for both Oo (9%) and for Ss (10%) sentences. For both I and II, the greatest proportion of strategic errors were parallel in nature, and were characterized primarily by Ss conversions; the smallest proportion of strategic errors were Oo in nature.

In contrast to Conditions I and II, error patterns for Condition III subjects showed variability in the direction of proportional changes over the three Testing Periods. For example, SVO increased by 15% between the first two test periods and then dropped by 12% between the Posttest periods. One could note that the use of the Oo conversion decreased by 7% and that employment of the First Noun strategy increased by 6% between Pre- and Posttest 2 Period. These inconsistencies in error pattern may be attributed to the fact that Condition III received no training on relative clause sentences. Similar to Conditions I and II, Condition III most frequently generated Ss conversions; however, it was the SVO strategy that was used least frequently.

TABLE 4 - 14

PERCENTAGE OF PREDICTED STRATEGIC ERRORS ACCORDING TO TRAINING CONDITION, TESTING PERIOD (PRETEST, POSTTEST 1 = PT 1, POSTTEST 2 = PT 2), AND STRATEGY TYPE

Strategy	Condition I			Condition II			Condition III		
	Pretest	PT 1	PT 2	Pretest	PT 1	PT 2	Pretest	PT 1	PT 2
First Noun	.29	.09	.13	.27	.22	.21	.06	.18	.12
SVO	.12	.26	.17	.00	.26	.21	.00	.15	.03
Parallel Oo	.04	.04	.17	.13	.09	.04	.25	.18	.18
Parallel Ss	.37	.43	.39	.47	.35	.37	.37	.26	.39
(Oo + Ss)	(.41)	(.47)	(.56)	(.57)	(.44)	(.41)	(.62)	(.44)	(.57)
Extraposition	.17	.17	.13	.13	.09	.17	.31	.22	.27

In general, the performance pattern for subjects in each Condition was consistent across Testing Periods. Table 4-15 illustrates for each sentence type the number of errors accounted for by each predicted strategy for all Conditions and Testing Periods.

First consider the Ss sentence type. At each Testing Period, the SVO strategy described virtually all errors made by each Condition. It can be noted that subjects in Condition III produced fewer errors on this sentence type than subjects in Conditions I and II.

Next, errors made by Conditions I and II on Os sentences, revealed a primary use of the parallel function Ss conversion across Testing Periods. The error pattern of subjects in Condition III differed somewhat. Specifically, at Pretest and Posttest 1 Periods, the Ss and Oo parallel function conversions were used almost equally to interpret the Os sentences. By Posttest 2 Period, however, there was an increase in Condition III subjects total number of errors on Os sentences with full employment of the Ss conversion for interpretation.

Examination of the Oo sentences indicates that for all Conditions, both the extraposition and First Noun strategies defined the errors on an approximately equal basis. In addition, the number of errors for subjects in Condition III increased on this sentence type over time.

Finally, inspection of the So sentences reveals that the parallel function strategy accounted for the majority of all

TABLE 4 - 15

NUMBER OF PREDICTED STRATEGIC ERRORS ACCORDING TO TRAINING CONDITION, TESTING PERIOD (PRETEST, POSTTEST 1 = PT 1, POSTTEST 2 = PT 2), SENTENCE TYPE AND STRATEGY TYPE

Sentence Type	Strategy	Condition I			Condition II			Condition III		
		Pretest	PT 1	PT 2	Pretest	PT 1	PT 2	Pretest	PT 1	PT 2
Ss	First Noun	0	0	0	0	1	0	0	0	0
	SVO	3	6	4	0	6	5	0	4	1
Os	First Noun	1	0	0	0	0	0	0	0	0
	Parallel Oo	0	0	1	0	1	0	2	2	0
	Parallel Ss	5	6	4	2	3	1	1	2	7
	(Oo + Ss)	(5)	(6)	(5)	(2)	(4)	(1)	(3)	(4)	(7)
	Extraposition	0	0	0	0	1	1	0	1	0
Oo	First Noun	3	2	3	3	3	4	1	4	3
	Extraposition	4	4	3	2	1	3	5	5	9
So	First Noun	3	0	0	1	1	1	0	1	1
	Parallel Oo	1	1	3	2	1	1	2	3	6
	Parallel Ss	4	4	5	5	5	8	5	5	6
	(Oo + Ss)	(5)	(5)	(8)	(7)	(6)	(9)	(7)	(8)	(12)

errors evidenced by each Condition at all Testing Periods. For Condition I, So sentences were chiefly interpreted as Ss sentences at the Pre- and Posttest 1 Periods while the First Noun strategy was utilized but to a lesser degree on the Pretest. At the Posttest 2 Period, subjects in Condition I continued to generate parallel function Ss conversions although the sentences were interpreted as Oo more frequently than before. For Condition II, the Ss parallel function conversion played a major role at every Testing Period, although the Oo parallel function conversions and First Noun strategies were always minimally present. Condition III employed the parallel function strategy, with an increase seen in the proportional use of the Oo conversion over time. The First Noun strategy was also occasionally used at Posttest 1 and Posttest 2 Periods. Subjects in Condition III evidenced a gradual increase in errors across Testing Periods on this sentence type as compared to Conditions I and II.

While the minimal predicted strategy changes that could be extrapolated from this error data were described above, the overall picture must be re-emphasized. It is obvious that the subjects' error patterns remained essentially uniform throughout the Testing Periods in every Condition on all sentence types.

2. Nonpredicted Strategy Errors

The nonpredicted errors were analyzed with respect to clause enactment on the four relative clause sentence types

for all Conditions. Following are definitions of each NPS error category used in this study.

(1) Main Clause Error (M Error) was an enactment in which a child incorrectly performed the main clause, but correctly performed the subordinate clause.

(2) Subordinate Clause Error (S Error) was an enactment in which a child incorrectly performed the subordinate clause but correctly performed the main clause.

(3) Main plus Subordinate Clause Error (M+S) was an enactment in which a child incorrectly performed both clauses in the stimulus sentence.

(4) Subordinate Clause Omit, Main Clause Correct Error (S Omit, M+) was an enactment in which a child correctly performed the main clause, but neglected to carry out the subordinate clause.

(5) Main Clause Omit, Subordinate Clause Correct Error (M Omit, S+) was an enactment in which a child neglected to carry out the main clause but correctly performed the subordinate clause.

(6) One-Clause Incorrect Error (One-Clause (-)) was an enactment in which a child performed one clause which was neither the main nor subordinate clause of the stimulus sentence.

(7) Three-Clause Error was an enactment in which a child performed three clauses, rather than two.

Table 4-16 displays the seven categories of NPS errors

TABLE 4 - 16

NUMBER OF NONPREDICTED STRATEGIC ERRORS ACCORDING TO TRAINING CONDITION, TESTING PERIOD (PRETEST, POSTTEST 1 = PT 1, POSTTEST 2 = PT 2) AND STRATEGY TYPE

Strategy	Training Condition: Condition I			Condition II			Condition III			Conditions and Periods Combined	
	Pretest	PT 1	PT 2	Pretest	PT 1	PT 2	Pretest	PT 1	PT 2	Total #	Total %
M Error	1	3	2	4	4	2	5	0	6	27	.12
S Error	6	5	4	6	5	1	12	8	4	51	.22
M + S Error	11	9	4	22	8	4	18	14	6	96	.42
S Omit, M +	4	0	0	4	0	0	0	1	1	10	.04
M Omit, S +	1	0	0	0	0	0	0	0	0	1	.00
One-Clause (-)	5	0	0	3	0	0	3	5	3	19	.08
Three-Clause	9	1	0	6	0	0	7	0	0	23	.10
Total	37	18	10	45	17	7	45	28	20		

made by each Condition at the three Testing Periods. The total numbers of errors made on the Pretest were similar for all Conditions. A subsequent decrease was noted from the Pretest through the Posttest 2 Period for every Condition; but at Posttests 1 and 2, Condition III showed more errors than Conditions I and II.

Consideration will now be given to NPS errors by individual category. The M+S category accounted for most errors in the Pretest. Although the frequency of this type of error decreased from Pretest to Posttest 1 and again from Posttest 1 to Posttest 2, it represented the primary source of error for each Condition and overall (i.e. 42%).

Further inspection of these data by category reveals that 22% of NPS errors made were of the S type and approximately equivalent proportions were attributed to the M and Three-Clause error categories (12% and 10%, respectively). The S category manifested a decrease in error rate, especially for Conditions II and III, across Testing Periods. The pattern for the M category remained essentially the same over time for all Conditions. One-Clause (-) errors accounted for 8% of the NPS errors made.

Of interest is a closer examination of the One-Clause (-) errors, which were nonexistent for both Conditions I and II by the first Posttest. The One-Clause (-) error rate for Condition III remained essentially unchanged across Testing Periods. These data suggest that training on the two-clause conjoined sentences given to the subjects in Condition III

did not facilitate those children's ability to figure out the ways grammatical relationships are expressed in relative clause constructions. On the other hand, it appears that the relative clause training received by subjects in Conditions I and II was of greater benefit with regard to this ability.

Furthermore, it can be seen that Three-Clause errors dropped out from Pretest to Posttest 2 for all Conditions. This finding suggests that all children learned (and most by Posttest 1) that there were only two actions to be performed.

A breakdown of NPS errors by sentence type indicates that errors were distributed in essentially the same proportion for all four types (Table 4-17). In addition, total number of NPS errors decreased by about the same amount between Pretest and Posttest Phases for all Conditions. Consideration of categorical NPS errors at each Testing Period shows that, at Pretest, all sentence types, other than Ss, were most vulnerable to the M+S error; the S category accounted for more errors on the Ss sentences. At the Posttest 1 Period, a decrease in error rate was seen for all sentence types. Although the Os and Oo sentences were still most vulnerable to the M+S error, the Ss and So errors were distributed similarly between the S and M+S categories. Error rates continued to drop at the Posttest 2 Period for all sentence types. Most Os and Oo errors were accounted for by the M and M+S categories; So errors were explained mainly by the S and M+S categories; and the Ss sentences fell into the M, S, and M+S error categories. (Other persistent but

TABLE 4 - 17

NUMBER OF NONPREDICTED STATEGIC ERRORS ACCORDING TO SENTENCE TYPE, TESTING PERIOD (PRETEST, POSTTEST 1 = PT 1, POSTTEST 2 = PT 2) AND STRATEGY TYPE

Strategy	Sentence Type Ss			Os			Oo			So			Sentence Types and Periods Combined
	Pretest	PT 1	PT 2	Pretest	PT 1	PT 2	Pretest	PT 1	PT 2	Pretest	PT 1	PT 2	
M Error	2	1	4	5	1	3	2	2	2	1	3	1	27
S Error	14	5	5	4	3	1	2	3	0	4	7	3	51
M + S Error	8	5	3	15	9	4	17	8	4	11	9	3	96
S Omit, M +	1	0	0	4	0	1	1	0	0	2	1	0	10
M Omit, S +	0	0	0	1	0	0	0	0	0	0	0	0	1
One-Clause (-)	2	1	0	2	2	2	3	1	0	4	1	1	19
Three-Clause	7	1	0	3	0	0	6	0	0	6	0	0	23
	34	13	12	34	15	11	31	14	6	28	21	8	
Total		59			60			51			57		

not predominant errors were of the One-Clause (-) and Three-Clause types, which appeared on each sentence type at Pretest and decreased similarly over time.) It appears, then, that although a minimal difference was noted for Ss sentences at the Pretest Period, the M, M+S, and S categories were the major sources of errors for all sentence types by the Posttest 2 Period.

A comparison of each Condition's errors by category and sentence type simply revealed that Condition III subjects had a greater number of NPS errors for every sentence type but there was no pattern effect of errors between Conditions. This finding is summarized in Table 4-18. The categories of errors by sentence type and Testing Period are displayed for Conditions I, II, and III in Appendix G.

Summary

This Chapter has reported the results of the present study with regard to the following areas: the correct response data on relative clause sentences measured at the three Testing Periods; performance during the Intervention Phase; the for/to response data, as well as the error response data on relative clause sentences at the three Testing Periods. Overall interpretation of the findings from this study, as well as some general comparisons with other studies have been provided. More in-depth discussion of these results, both with regard to the specific goals of this research and in relation to the relevant literature, will be handled in Chapter V.

TABLE 4 - 18

TOTAL NUMBER OF NONPREDICTED STRATEGIC ERRORS ACCORDING TO SENTENCE TYPE AND TRAINING CONDITION

	Sentence Type			
Condition	Ss	Os	Oo	So
I	20	14	16	15
II	14	20	15	19
III	25	26	20	24

CHAPTER V

DISCUSSION

We will now address the findings with respect to the theoretical question posed in the Problem section of this thesis: is it possible to exploit the child's innate ability to learn language through direct intervention and trigger hypothesis-forming mechanisms to facilitate the comprehension of syntactic structures at an accelerated rate?

The results will be organized and discussed sequentially, addressing each of the two major goals of this investigation. The first major goal was to determine whether direct intervention can accelerate the young child's development of comprehension abilities by teaching a strategy (or set of strategies) for understanding four types of relative clause sentences. The second major goal was to identify the heuristic strategies used by the subjects in their attempts to understand those sentences and to compare the children's use of strategies with three competing hypotheses of sentence processing. In the final section of this Chapter, consideration will be given to implications of this research for developmental psycholinguistics and for language disorders in children.

Effects of Direct Intervention on Accelerating Language Learning

The results of this experiment clearly demonstrated that direct intervention was effective. The solid improvement in the performance of the subjects in the two experimental conditions, Conditions I and II, on the relative clause sentences over time contrasted sharply with the lack of improvement demonstrated by subjects in the control condition, Condition III. These marked differences were significant between the Pretest and Posttest 1 Periods and even more dramatic between the Pretest and Posttest 2 Periods. While correct performance rate on the relative clause sentences for Conditions I and II increased significantly between the Pre-and Posttest Phases, Condition III's performance remained essentially the same. Thus, these results confirm the effectiveness of the two experimental training procedures and provide support for the first major hypothesis of this study, that children can be trained to understand relative clause sentences at an accelerated rate. Moreover, the outcome shows that the parameters of the language learning mechanism are perhaps more malleable than other forms of human cognition, at least during childhood.

Obviously, on the basis of this research, one cannot make a general statement that direct intervention would be successful in accelerating children's comprehension of all sentence types. However, the evidence here indicates that children between 3 years, 6 months, and 4 years, 6 months, in

the two experimental conditions, demonstrably learned the four relative clause sentence types examined. Thus, the potential for expediting language learning exists. Further research utilizing a similar intervention paradigm would certainly be necessary to determine whether other syntactic constructions are amenable to accelerated learning.

The discrepancy between the effectiveness of intervention on language acceleration evidenced in this investigation and the general unsuccessful attempts to accelerate other forms of conceptual learning (i.e. conservation) through both verbal- and nonverbal-mediated tasks, (Wohlwill and Lowe, 1962; Smedslund, 1961a,b; Inhelder and Sinclair-de-Zwart, 1967), points up an interesting phenomenon. It appears that the psychological operations required for language learning (and language processing) are at least in part, qualitatively different from those operations required for other kinds of conceptual learning.

Additional support for the independent integrity of the linguistic system is found in Beilin and Kagan's (1969) successful attempt to teach children the linguistic rule for plurality. Recall that the performance of their subjects, between 3 years, 1 month, and 5 years, 6 months, improved on both the number-conceptualization and verb-pluralization training whether or not they possessed the number concept prior to intervention. So, language training appeared to be the significant agent of change independent of the language or concept status of the learner at the outset. Also of note

are the verbal training effects on three classes of linguistic attributes reported by Inhelder and Sinclair-de-Zwart (1967). While the acquisition of the verbal expressions taught did not yield improved performance on their posttest conservation task, more than half of the children demonstrated spontaneous and correct use of the linguistic attributes (e.g. more and less) to describe the covarying dimensions of the items used in the conservation posttest. Although the learning of the verbal expressions did not seem to help these children conserve, it is important to point out that direct intervention was effective at the linguistic level, providing further evidence that the language learning mechanism may operate in ways that are different from and to some degree independent of other forms of learning.

It is apparent that any generalization regarding the uniqueness of language and the operations of the language learning mechanism must at least be tempered by the recognition that the vast differences in methodologies used in the various studies may be an important factor. Likewise, caution must be observed in interpreting the results of cross-study comparisons such as these, because of the different age groups with which intervention was attempted. It may be that the extent to which general conceptual development constrains language learning becomes more pronounced as the child gets older. Having suggested a plausible interplay between language acquisition and

cognitive development, it is clear that research to date is insufficient for any definitive conclusions to be reached.

Effects of Different Training Procedures on Accelerating Language Learning

The degree of improvement demonstrated on the relative clause sentences was similar for Conditions I and II, disconfirming the second major hypothesis, that the two experimental training procedures would be differentially effective, resulting in better performance in Condition I than in Condition II. It can be recalled that the training procedure received by I was designed to test indirectly Slobin's (1973) putative universal to avoid interruption and word rearrangement of linguistic constituents. That is, children in Condition I were taught noninterrupted versions of the relative clause sentences. In contrast, the training procedure for the children in Condition II was designed for them to rely solely on their natural inductive capacities. Returning to the issue at hand, the results do not support Slobin's principle that interruption of related linguistic units pose increased processing complexity for children.

From the standpoint of short-term memory (STM), it appears that interruption was not a central factor in the present study from the outset. Certainly, the improved performances of Conditions I and II in comparison to III was not a result of increasing I and II's STM stores in the Intervention Phase. Rather, the learning demonstrated by I

and II probably reflects that the children studied acquired the ability to make more efficient use of the memory capacity they already possessed, while III did not.

The equivalent correct performance rates exhibited by Conditions I and II suggest that rather than learning particular strategies, as predicted, children in both experimental conditions acquired a more global strategy for processing the relative clause sentence types trained. This conclusion is borne out not only by the similar quantitative performances displayed by the two groups of children, but also by their qualitative performances. That is, the hierarchy of sentence difficulty (i.e. Ss > Os > Oo > So) was the same for both experimental conditions (and the control condition) in the Pretest Phase and remained the same throughout the Posttest Phase. Comparisons of Condition I's and Condition II's performance during the Intervention Phase is further enlightening. In fact, the relative processing complexity of the four sentence types changed in each of the three training sessions for children in both conditions and was never the same as that demonstrated in the Pre-and Posttest Phases. Indeed, then, it appears that the children in the two experimental conditions did not learn particular or different comprehension strategies, but learned to attend to important aspects of relative clause sentences engaging their own natural capacities for processing language.

Heuristic Strategy Use and Hierarchical Sentence Type Difficulty in Young Children

The comprehension strategies employed by the subjects in their attempts to understand relative clause sentences will not be addressed in relation to the strategic errors predicted by the hypotheses discussed in Chapter II. A discussion of the for/to sentences will be incorporated where appropriate. Before proceeding, it should be noted that the order of sentence difficulty comparisons will be made with Testing Periods and Conditions pooled, since the hierarchy did not differ significantly between Conditions or across Testing Periods as demonstrated by the nonsignificant second-order interactions.

The subject focus sentences, Ss and Os, were significantly easier to understand than the object focus sentences, Oo and So. There was no significant difference in correct performance rate between the two types of subject focus sentences, nor was there a significant difference between the object focus sentences. Of the object focus sentences, So proved to be most difficult and received significantly fewer correct responses than either of the subject focus types.

In general, the pattern of strategy use for subjects in each condition was consistent across testing periods. In viewing the error data, the great preponderance of strategic errors pointed to an overreliance on the parallel function strategy. This would appear to lend credence to Sheldon's

(1974) parallel function hypothesis. A closer examination of the precise nature of the parallel function error enactments, however, shows that approximately three times as many sentences were converted to Ss than to Oo sentences. More specifically, there was a tendency to interpret Os and So sentences as subject relatives with subject focus rather than to interpret them as object relatives with object focus. Interestingly, in most of the former cases, the NP perceived as the subject of both the main and subordinate clause was the first NP heard. Thus, word order seems to have been the overriding variable affecting these children's comprehension, from two standpoints.

From the standpoint of focus, the subjects demonstrated an obvious preference for preserving canonical word order as seen by their predilection for making the relativized NP focus on the first heard noun. Secondly, the fact that in most cases, children interpreted the first heard noun as the subject of both clauses, indicates that they were overrelying on the First Noun strategy in their attempts to comprehend nonparallel sentences. When viewed in this light, these data are best accounted for by the predictions of the canonical-sentoid hypothesis. Further, when the frequency of use of the SVO and First Noun strategies are combined with the strategic errors just discussed, this argument becomes even more appealing.

Inspection of the children's correct performance rate on the for/to sentences reveals that the same processing

variable that was operative in the children's comprehension of embedded relatives, Ss and So, was found in the for/to sentences. That is, the embedded for/to sentences (nonparallel constructions) seemed likewise to be interpreted using the First Noun strategy, as would be predicted by the canonical-sentoid hypothesis. It must be kept in mind however, that in general, the for/to sentence data obtained in this study were not very informative.

Although the for/to sentence results showed that subjects' scores improved significantly between Pretest and Posttest Phases, one cannot attribute these findings to a transfer effect of the training received on the relative clause sentences. No significant differences in performance on the for/to sentence types was found among the three groups of children studied. In other words, the rate of the control groups' improvement on both parallel and nonparallel sentences was essentially the same as for the two experimental groups. Moreover, in the Pretest Phase, the extremely high scores obtained by the subjects on these two sentence types showed that there would be little room for improvement. In fact, a ceiling effect was evidenced in the Posttest Phase. It also must be recognized that the subjects were not matched for their performance on the for/to sentences following the Pretest Phase. Due to these factors, more in depth comparisons and comments are beyond the scope of the present study.

Returning for a moment to the order of difficulty among

relative clause sentence types, the results of the present study are not indicative of the same pattern reported by Sheldon (1974). She found that children from 3 years, 8 months, to 4 years, 3 months, employed the parallel function strategy successfully on object relatives with object focus before they successfully applied this strategy to subject relatives with subject focus. If parallel function was the only operating variable, So and Os sentences should have been of equal complexity, which was not the case in either Sheldon's study or the present study. Actually, Sheldon's preschoolers demonstrated significantly worse performance on the So type than on its nonparallel counterpart, Os. In addition, the interaction between the Object/Subject and Parallel/Nonparallel factors found here, precludes the possibility that parallel function was a unitary variable affecting comprehension of the relative clause sentences under consideration. Hence, the parallel function hypothesis alone could not account for the relative order of processing difficulty for children within this age range. On the other hand, the First Noun strategy predicts that relatived subjects would be easier to understand overall than relativized objects, thereby providing further support for the canonical-sentoid hypothesis.

At this point, it is instructive to recall that Brown's (1971) 3-, 4-, and 5-year olds demonstrated the same pattern of performance among relative clause sentence types (i.e. subject focus relatives were significantly easier than object

focus relatives) as that obtained in this investigation. He claimed that relative clause focus and canonical order within clauses were a significant factors influencing his subjects' comprehension. While differences in methodologies cannot be ignored, there remains a striking similarity between his findings and the results documented in this study.

To recapitulate, the canonical-sentoid hypothesis was clearly supported by the data from the present study. Conversely, no support was found for the interruption hypothesis; children as a group had no more difficulty enacting self-embedded sentences than right branching ones. Finally, a critical analysis of the childrens' erroneous responses revealed rather weak support for the parallel function hypothesis.

Heuristic Strategies Used in Relative Clause Sentence Processing Across Different Age Groups: Cross-Study Comparisons

It is worthwile to now view the results of this study with young normal children (3-4 years old) in comparison to results from other studies examing the same linguistic constructions with older normal children and adults. Such a discussion may shed light on the similarities and differences between the use of comprehension strategies for understanding relative clause sentences as the individual becomes a more sophisticated language user.

Wallach (1977), in evaluating the comprehension of

relative clause sentences in normal 8- to 13-year olds, found evidence for a temporal-order strategy. The specific nature of the strategy employed by children who demonstrated errors on the individual processing task was to assume that the first (or the last) N-V-N sequence was the actor-action-recipient of that sequence (p. 142). Overall, the object relatives were found to be easier than the subject relatives; performance on the So sentences was overwhelmingly inferior to that of the other three sentence types.

In her study of adults of varying ages, Feier (1977) found support for Sheldon's (1974) parallel function hypothesis (i.e. parallel function sentences were easier than nonparallel sentences). Like Wallach, Feier found that the So sentences proved more difficult than all other sentence types. In an effort to explain the far greater preponderance of errors on the nonparallel So sentences than on their Os counterparts, Feier posited a temporal strategy. She reasoned that a temporal strategy more economically accounted for the predicted strategic errors made by her subjects, since the parallel function hypothesis alone could not explain the performance discrepancy between the two nonparallel constructions. As described in Chapter II, Feier's temporal strategy is delineated by three sequential principles: (1) a noun following a verb will be enacted as the object of that verb; (2) a noun preceding a verb will be enacted as the subject of that verb; and (3) applicable to only So sentences, is that the first heard noun will serve as

the subject of the first heard verb, and the second heard noun as the object of the first heard verb (pp. 125, 127).

Despite the apparent differences between Feier's and Wallach's "temporal" strategies, closer analysis reveals that they are not qualitatively different from one another. Rather, Feier's temporal strategy may merely represent a more sophisticated and adult version of the strategy used by Wallach's 8- to 13-year olds.

In contrast to Wallach and Feier, Sheldon (1977) noted that her young adult subjects' performance on relative clause sentences supported the predictions of the interruption hypothesis. Relative clause sentences in which the object NP was relativized, the SO and OO types, were significantly harder than relative clauses in which the subject NP was relativized. Further, main clauses that were interrupted, the SO and SS types, were significantly harder than noninterrupted main clauses, the OS and OO types. Once again, SO sentences were always most difficult. To explicate the difficulty of interruption and word order rearrangement, Sheldon coined the adjacency strategy, which in essence stated that the subjects first grouped together as constituents of the same construction the two adjacent NP's and an adjacent, noninitial verb, not already assigned to a clause. Based on this parsing, they then interpreted the first NP as the subject of the verb, and the second NP as the object of the verb (p. 312). Unlike Feier's and Wallach's enactment tasks, Sheldon used a memory probe procedure to

measure processing difficulty. In spite of the performance differences that may be task-related, some comparisons can be made. A perusal of Sheldon's adjacency strategy reveals that in large part, it seems extremely similar to that of Feier's postulated temporal strategy. Both appear to be temporal strategies whose clause segmentation principles are of a more precise nature than Wallach's more general, all-encompassing temporal-order strategy.

To this investigator, it seems that all three authors argue that the processing difficulty associated with the relative clause sentences under consideration can be best explained by a temporal strategy. Perhaps, the term "temporal strategy" is a more parsimonious description of the strategic error tendencies evidenced by older children and adults than are other predicted strategies. For young children, however, whose strategies are partially noncompetency based, error patterns may better lend themselves to different interpretation. As found in the present study, 3- and 4-year old children relied heavily on the First Noun strategy to interpret singly embedded relative clause sentences. Such a finding is not surprising since the First Noun strategy, the most primitive form of the adult canonical order strategy, is one of the first strategies to operate developmentally. The young child's reliance on this strategy probably reflects a lack of knowledge that canonical order can be violated. Thus, canonical order seems to be a pervasive strategy, rooted in the early stages of language

acquisition, and continues to operate through adulthood.

When viewed from a broader perspective, it can be said that canonical order strategies and strategies discussed by Wallach (1977), Feier (1977), and Sheldon (1977) are not mutually exclusive. Essentially, all strategy groups predict a reliance on word order for sentence interpretation. Therefore, a comparison between the performance of young children, older children, and adults, suggests a progression of strategy use, characterized by changes in the relative reliance on different strategies at particular points in language development. That is, overuse of strategies change with the gradual acquisition of linguistic competence.

Other Types of Errors

Thus far, this Chapter has described the error data with regard to earlier studies that predicted certain strategies subjects might use in attempting to comprehend relative clause sentences. It is now necessary to consider the errors found in the present study that did not result from predicted strategies, since of the 435 errors made, 227 or 52% were nonpredicted strategic (NPS) errors. The NPS errors were classified according to clause enactment by sentence type. The NPS errors were distributed in essentially the same proportion for all four kinds of sentences. Although the most prevalent errors involved an incorrect enactment of both the main and subordinate clauses and an incorrect enactment of the subordinate clause only, (accounting for 42% and 22%

of the total number of NPS errors, respectively), the One-Clause (-) errors and the Three-Clause errors were the most interesting. First consider the One-Clause (-) error in which a child performed only one clause which was neither the main nor the subordinate clause of the stimulus sentence. While such errors were nonexistent for the experimental conditions, Conditions I and II, by the first posttest period, the control condition, Condition III, exhibited this error at essentially the same rate across all testing periods. The persistance of this random error suggests that the conjoined sentence training received by the children in Condition III did not facilitate their ability to cope with the ways in which grammatical relations are expressed in singly embedded relative clause sentences.

Of equal interest is the Three-Clause error category, in which a child performed three clauses rather than two. This type of error completely disappeared between the Pretest Period and the Postest 2 Period for all Conditions. Thus, despite the type of training received, it appears that all subjects became aware that the mention of two verbs required the performance of only two actions.

The distribution of Main Clause and Subordinate Clause errors displayed by the 3- and 4-year olds in this study were compared with those exhibited by the adults in Feier's (1977) and Sheldon's (1977) investigations. Not surprisingly, the error distributions were dissimilar. A comparison of Sheldon's adults with Feier's adult groups combined, also

reveals a different distribution of main and subordinate clause errors. Even when Feier's youngest age group (18-to 25-years old) is isolated and compared with Sheldon's adults of similar age (university students), one discovers essentially the same variability of sentence type distribution on main and subordinate clause errors, although the patterns are somewhat more similar.

Therefore, it is difficult to draw firm conclusions about a categorical nature of clause errors based on these cross-study comparisons. Feier's error classification system, consisting of five categories was much more elaborate than Sheldon's. Sheldon examined only two categories, namely, main clause errors and subordinate clause errors. In addition, the different tasks used by these investigators may have had an effect on their distribution of errors. Also to be recognized is that these adult subjects studied exhibited extremely low error rates overall, making it difficult to discern discrete patterns of performance based on such a small data pool.

The distribution of NPS errors demonstrated by the children in the present study were not in accordance with those demonstrated by the adults. This phenomenon seems logical since it has already been shown that young children make different kinds of strategic errors in processing relative clause sentences than do adults. Therefore, one would not expect their NPS errors to conform to those of adults. Finally, the error classification system used in the

present study may not have been sensitive enough to tap certain performance indices that would have been more informative, possibly representative of a transitional phase through which children proceed between application of nonpredicted and predicted strategies.

Implications for Developmental Psycholinguistics and Language Disorders in Children

From a developmental psycholinguistic point of view, the major finding of this investigation was that direct intervention was effective in accelerating 3- and 4-year old children's comprehension of singly embedded relative clause sentences. This finding requires attention and provokes several questions. One wonders whether direct intervention would be successful in expediting learning of other syntactic constructions. One also wonders whether age may be a critical factor. Perhaps, there is an age (or stage) beyond which direct intervention would not result in accelerating integrated language learning.

When we turn to the issue of strategies, other important issues arise. It seems clear that the extent to which individuals rely on different processing strategies change over the course of development; the precise progression of strategy use and the factors which underly these changes and refinements remain unresolved. A longitudinal approach may be of great value in delineating these factors. In any case, this area merits the attention of future research. It is

also of interest to consider the exact relationship between canonical order strategies, temporal strategies, adjacency strategies, and parallel function strategies, as they operate at a given age and as they may alter in character from early language learning to adulthood. One wonders, for example, at what age the temporal strategy emerges and how its evolution may be entwined with other aspects of language acquisition. Another related issue centers specifically around the phenonemon of parallelity. Is this strategy specific to the processing of singly embedded relative clause sentences or would its application extend to other sentence structures as well? One thing seems clear; the So sentence type was most difficult for all subjects, regardless of age. The consistency of this finding suggests that further study of this particular sentence type may yield worthwhile information about sentence processing and strategy preference in both children and adults.

While the present research concerns syntactic development, certain pragmatic phenomena arose that may provide insight into the development of discourse. Until relatively recently, most studies of language development overlooked the notion that the child learns language within the context of acquiring the social skills of initiating and maintaining a conversational exchange. The current explosion of work on the development of pragmatic abilities has highlighted the idea that language is largely used for communicative purposes, an interactive process. To paraphase

Bruner (1975), the language is a specialized and conventionalized extension of cooperative action and is acquired as an instrument for regulating joint activity and joint attention.

This thrust can be seen in Schlesinger's (1971) and Bowerman's (1976) study of communicative functions; in Hymes' (1971) and Labov's (1966) establishment of the field of sociolinguistics; in the work on communicative intentions pursued by Dore (1975, 1976, 1977), Bates (1976) Bates, Camaioni, and Volterra (1975), Gruber (1975), Nelson (1976), Antinucci and Parisi (1975), and Halliday (1973, 1975); and in the growing interest in the study of discourse or conversation evidenced by Keenan (1974), Bloom, Hood, and Rocissano (1976), Garvey (1975), Keenan and Schieffelin (1976), Shatz and Gelman (1977) Grice (1975), Sacks, Schegloff, and Jefferson (1974), Donahue (1977), and Sachs (1977), etc.

The idea is that children learn language as they use language, both to understand and to produce sentences in interactive communicative contexts. In this light, the importance of context in the study of child language has come to the forefront. Apparently, children use a great deal of surface information provided by the context of language use as they go about the job of making sense of what is said. They take advantage of knowledge of shared intentions and of nonlinguistic contextual cues (including situational cues, status relationships among the participants in an

interaction, and physical surroundings) to decipher incoming messages (Cook-Gumperz, 1965). Understanding sentences, then, involves interpreting them against the background of one's knowledge of the world, the way people behave in it, and knowledge of conversational constraints as well as knowledge of the literal meaning of utterances which is derived from syntactic form and lexical meaning.

The prospects for examining sentence processing in children is most exciting when viewed from the standpoint of how specific linguistic, social, and cognitive systems operate across sentences and in the communicative context. One avenue of endeavor that may shed further light on how young children process incoming messages as well as on childrens' strategy preferences is the contingent query, which Garvey (1975) demonstrated is fairly well-established in the normal child's communication system by 3- to 4-years of age.

The contingent query serves an important function in the regulation of discourse. It is a request for more information or for clarification (Garvey, 1975, 1977). To illustrate, consider the following interaction:

Speaker	A:	I saw John, you know.
Speaker	B:	What?
	A:	I saw John.
	B:	Who?
	A:	John
	B:	Where?
	A:	At the market.
	B:	Yeah! How is he?

As seen in this hypothetical exchange, contingent queries serve different functions. What? is a straight request for repetition of part or of the entire message. Who? alerts a speaker to a specific portion of the utterance that requires repetition or clarification. Where? does not request repetition (because the basic proposition has been communicated), but the listener requests further, previously unspecified information (deVilliers and deVillers, 1978). One intersting aspect of the contingent query is that it can be inserted into the ongoing conversation without disrupting the overall sequence. That is, once the information is provided, the dialogue proceeds as before, with the listener responding to the initial utterance.

This pragmatic aspect comes to mind because, in the present study, children frequently used contingent queries. A typical example can be seen in the following exchange:

STIMULUS SENTENCE: The turtle that chases the dog slaps the pig.
CHILD's RESPONSE: What does the turtle do to the dog?

Obviously, due to predetermined methodological constraints, the child was merely told to "take a guess" or "try to remember". However, an analysis of the frequency and types of contingent queries used by the subjects on the different sentence types may have provided better insight into both their predicted and nonpredicted strategic errors.

An extension of this approach would entail supplying feedback to the child's query in the Intervention Phase and

recording their revision strategies following provision of the requested information. The Pretest and Posttest Phase would remain the same as in the present study, providing no feedback to the child.

It is worthwhile to point out that the group of children who received feedback training in Beilin's (1974) study, showed significantly improved performance on the posttest area conservation task. While the feedback provided was not in response to a contingent query, it gave children information as to the correctness or incorrectness of their responses. Beilin's results suggest that rather than acquiring a new set of strategies for dealing with area conservation, the subjects used revision behaviors to search for the appropriate strategy when confronted with the incorrectness of their prior inferences.

Feier (1977) and Wallach's (1977) use of thematization were certainly attempts to examine the effects of discourse on language comprehension. However, thematization in their studies involved the presentation of narrative passages, and only represents one dimension of discourse. While of value, narrative discourse does not yield important information about the ways in which listeners process utterances in everyday conversation. On the other hand, the contingent query, an acknowledged discourse regulator, may prove to be a more sensitive tool for studying the development comprehension system within a more "natural" communication setting.

Turning to language disorders in children, the clinical dimension represents a natural extension of the current research. Clearly, the notion of intervention is directly relevant for children exhibiting impaired communication systems. The issues involved in the application of normal language acquisition to the treatment of disordered language have been addressed repeatedly (Bricker and Bricker, 1970, 1974; Rees, 1972; Miller and Yoder, 1972, 1974; Lee and Canter, 1971; Lee, Koenigsknecht and Mulhern, 1975; MacDonald and Blott, 1974; Bloom and Lahey, 1978; Menyuk, 1971; Chappell, 1971). Within this massive body of literature, there is substantial support for using available normative data as the basis for the content of a language intervention program. It is argued that the organization and presentation of content material should be patterned according to the normal developmental sequence of language acquisition. Presumably, this hierarchy assists in determining the abilities and processes necessary for language learning, and helps to identify the stage at which a given child is functioning. In addition, ample documentation exists that intervention programs which were based on normal language acquisition have had successful outcomes.

The findings of the present investigation present numerous challenges for subsequent research. In this connection, one wonders whether comprehension strategies of certain groups of language disordered children can be altered, unlike the normal children studied here. Wallach

(1977), for example, found some evidence that the strategies employed by 8- to 13-year old learning disabled children could be changed. Perhaps, then, the two experimental training procedures used in the current study would yield differential learning effects with selected groups of language disordered children. This notion seems plausible since language disorders manifest themselves differently.

It is impossible to make a sweeping generalization about the effectiveness of any one intervention procedure for language disordered children in general. The credence of this statement is substantiated by the fact that no one intervention program, either reported in the literature or of commercial availability, has been demonstrated to be successful with groups of language disordered children who exhibit similar problems. Most of these intervention programs are product-oriented rather than process-oriented. That is, the pretraining baseline measurements used are designed to differentiate what a child is and is not doing at a particular stage of language development and then train to "fill the gaps". Few programs concern themselves with the processes that underly the products.

For clinical populations, it may be critical to identify strategy use prior to intervention. Such an approach may yield important information regarding the organization of a child's impaired linguistic system. Once insight is gained into the kinds of strategies a child employs to process certain types of incoming messages, intervention procedures

can be developed to modify or attempt to change a child's previously available strategy repetoire.

Obviously, the amount and intensity of training received by the subjects in Intervention Phase here, as well as the time intervals between training and the Postest Phase may not be applicable to language disordered children. Rate of learning and language learning styles are important variables to consider in future investigations.

While the majority of intervention programs reported in the literature have focused on teaching semantic, syntactic, and phonological aspects of language, there is evidence that pragmatic aspects also may be taught based on the normal developmental sequence philosophy. Darnton and Gallagher (1977), for example, demonstrated that language disordered children, in Brown's stages I, II, and III, were sensitive to conversational demands of the contingent query and employed revision strategies to resolve instances of communication breakdown. However, their language disordered subjects employed their linguistic structural knowledge to meet conversational demands in a qualitatively different manner than normal children at similar developmental stages. Here again, normative data seems to provide a viable guideline for facilitating a child's selection of more efficient and sophisticated revision strategies in a language disordered child.

The need for additional research is clear, since the parameters of "communicative competence" (Hymes, 1971) are

not yet clearly defined, much less is a predictable developmental sequence identified. However, the importance of such information is essential to understanding disordered language systems and is highlighted by the realization that structural aspects alone neither describe some of the bizarre communication patterns that speech pathologists often face nor offer adequate goals for clinical assessment and intervention (Rees, 1978).

Summary

This work has provided another approach to the study of language processing in children. The results of the experiment suggest that direct intervention is a viable methodology for accelerating specific aspects of language learning in young children. The use of intervention for expediting the acquisition of other linguistic forms is enticing and offers promising avenues for future exploration.

Appendix A

Time Layout of the Study

Time Layout of the Study

	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.
Week 1	---	Pretest	Pretest	Pretest	Pretest	---	---
Week 2	---	---	*TS1	TS1	TS1	---	---
Week 3	---	TS2	TS2	TS2	---	---	---
Week 4	TS3	TS3	TS3	---	--- .	---	---
Week 5	**PT1	PT1	PT1	---	---	---	---
Week 6	---	---	---	---	---	---	---
Week 7	***PT2	PT2	PT2	---	---	---	---

*TS = Training Session

**PT1 = Posttest 1

***PT2 = Posttest 2

Appendix B

Linguistic Materials

NOUNS AND VERBS USED IN THE COMPLEX SENTENCE COMPREHENSION TEST FOR PRETEST, POSTTEST 1, AND POSTTEST 2

Animate Nouns	Verbs
witch	push
boy	slap
man	kiss
fairy	sit on
lady	wave at
girl	chase

Inanimate Nouns
mouse
turtle
frog
duck
pig
dog

COMPREHENSION TEST SENTENCES IN THEIR ORDER OF PRESENTATION

		Sentence Label
1.	The witch is anxious to push the fairy.	F/T //
2.	The mouse slaps the turtle that chases the frog.	Os
3.	The duck that the pig slaps chases the frog.	So
4.	The boy is glad for the lady to kiss.	FT /X
5.	The dog that the mouse chases sits on the turtle.	So
6.	The turtle is glad to chase the mouse.	FT //
7.	The fairy who the man kisses pushes the girl.	So
8.	The witch pushed the boy who the man kisses.	Oo
9.	The man who waves at the lady pushes the boy.	Ss
10.	The duck is afraid for the frog to slap.	FT /\
11.	The turtle that chases the dog slaps the pig.	Ss
12.	The boy is glad to kiss the lady.	FT //
13.	The dog chases the pig that sits on the duck.	Os
14.	The witch is anxious for the fairy to push.	FT /\
15.	The frog sits on the turtle that the dog slaps.	Oo
16.	The lady waves at the fairy who kisses the witch.	Os
17.	The turtle is glad for the mouse to chase.	FT /X
18.	The mouse that slaps the frog sits on the duck.	Ss
19.	The duck is afraid to slap the frog.	FT //
20.	The pig slaps the duck that the mouse chases.	Oo

NOUNS AND VERBS USED IN THE THREE TRAINING SESSIONS

Training Session	Noun	Transitive Verb	Intransitive Verb
1	horse	kick	walk
	elephant	bite	sleep
Animal Farm	owl	stand on	run
	bunny		
	chick		
	cow		
2	Indian	kick	hop
	boy	hit	clap
The Circus	girl	jump over	dance
	fat lady		
	giant		
	clown		
3	giraffe	hit	shake
	donkey	bite	skip
The Zoo	lamb	fall on	crawl
	lion		
	squirrel		
	hen		

THE TRAINING SENTENCES (RELATIVE CLAUSE) USED FOR CONDITION I AND CONDITION II IN THEIR ORDER OF PRESENTATION FOR EACH OF THE THREE TRAINING SESSIONS

Training Session			Sentence Label
1	1.	The horse stands on the elephant that the owl kicks.	Oo
	2.	The bunny kicks the chick that the cow bites.	Oo
	3.	The cow that stands on the horse kicks the owl.	Ss
	4.	The elephant that bites the bunny stands on the chick.	Ss
	5.	The cow bites the owl that stands on the elephant.	Os
	6.	The chick stands on the bunny that kicks the horse.	Os
	7.	The chick that the cow kicks bites the elephant.	So
	8.	The owl that the bunny bites stands on the horse.	So
2	1.	The clown kicks the girl who hits the giant.	Os
	2.	The Indian jumps over the boy who kicks the fat lady.	Os
	3.	The fat lady who the giant kicks hits the girl.	So
	4.	The boy who the clown hits jumps over the Indian.	So
	5.	The giant kicks the girl who the boy hits.	Oo
	6.	The Indian jumps over the fat lady who the clown kicks.	Oo
	7.	The clown who hits the fat lady jumps over the boy.	Ss
	8.	The girl who jumps over the Indian kicks the giant.	Ss
3	1.	The lion that falls on the squirrel hits the hen.	Ss
	2.	The donkey that bites the giraffe falls on the lamb.	Ss
	3.	The lamb that the donkey hits bites the lion.	So
	4.	The giraffe that the hen falls on hits the squirrel.	So
	5.	The hen bites the lamb that the giraffe hits.	Oo
	6.	The squirrel falls on the lion that the donkey bites.	Oo
	7.	The lion bites the hen that falls on the giraffe.	Os
	8.	The donkey hits the squirrel that bites the hen.	Os

THE TRAINING SENTENCES (CONJOINED) USED FOR CONDITION III
IN THEIR ORDER OF PRESENTATION FOR EACH OF THE
THREE TRAINING SESSIONS

Training Session			Sentence Label
1	1.	The horse kicks the elephant and the owl walks.	T-I
	2.	The bunny bites the chick and the cow sleeps.	T-I
	3.	The cow stands on the horse and the owl runs.	T-I
	4.	The elephant kicks the bunny and the chick walks.	T-I
	5.	The cow runs and the owl stands on the elephant.	I-T
	6.	The chick sleeps and the bunny bites the horse.	I-T
	7.	The chick walks and the cow kicks the elephant.	I-T
	8.	The owl sleeps and the bunny bites the horse.	I-T
2	1.	The Indian hops and the giant kicks the boy.	I-T
	2.	The clown claps and the girl jumps over the fat lady.	I-T
	3.	The girl hops and the clown kicks the Indian.	I-T
	4.	The giant dances and the fat lady hits the boy.	I-T
	5.	The fat lady jumps over the giant and the girl claps.	T-I
	6.	The Indian kicks the clown and the boy dances.	T-I
	7.	The boy jumps over the girl and the giant hops.	T-I
	8.	The clown hits the fat lady and the Indian claps.	T-I
3	1.	The lion bites the hen and the lamb shakes.	T-I
	2.	The squirrel falls on the donkey and the giraffe skips.	T-I
	3.	The lamb crawls and the giraffe bites the lion.	I-T
	4.	The hen shakes and the squirrel hits the donkey.	I-T
	5.	The giraffe hits the lion and the hen crawls.	T-I
	6.	The donkey bites the lamb and the squirrel shakes.	T-I
	7.	The lion skips and the hen falls on the squirrel.	I-T
	8.	The donkey skips and the lamb hits the giraffe.	I-T

APPENDIX C

Composition of the Three Groups

THE COMPOSITION OF THE THREE GROUPS

	Group A	Group B	Group C
Sex	M = 2 F = 4	M = 4 F = 2	M = 3 F = 3
Mean Age	48.2 months* 4 years	47.6 months 4 years	47.5 months 3.11 years**
Age Range	43-52 months 3.7-4.4 years	42-52 months 3.6-4.4 years	44-51 months 3.8-4.3 years
Mean Score on Relative Sentences of Pretest	16.5%	16.5%	15%

* The notation 48.2 months should be interpreted as 48 months, 2 days. This notation for age is used throughout this Appendix.

** The notation 3.11 years should be interpreted as 3 years, 11 months. This notation for age is used throughout this Appendix.

Appendix D

Instructions for the Intervention Phase

INSTRUCTIONS FOR THE TRAINING PROCEDURES USED IN THE INTERVENTION PHASE FOR CONDITION I (EXPLICIT TRAINING CONDITION)

I am going to show you how you can make one big story into two little stories. First it's my turn. I'll show you and then you can have a turn.

Let's play with the object and the object and the object.

Listen to this story.

(Verbal presentation of the relative clause sentence.)

(Demonstration of the relative sentence with the toy objects.)

This big story is really two little stories put together. Listen.

(Verbal presentation of both clauses. After each clause is presented, it is demonstrated with the toy objects.)

Now I'm going to put the two little stories back together and make one big story. Listen.

(Verbal presentation of the relative sentence.)

Now you can have a chance to make the same story.

(The position of the objects on the table is changed by the examiner.)

Show me the story; (Verbal presentation of the relative sentence.)

This training sequence was repeated for each target sentence.

INSTRUCTIONS FOR THE TRAINING PROCEDURES USED IN THE INTERVENTION PHASE FOR CONDITION II (IMPLICIT TRAINING CONDITION) AND FOR CONDITION III (CONTROL CONDITION)

Condition II

Today I'm going to show you how you can make some stories.

First it's my turn. I'll show you and then you can have a turn.

Let's play with the object and the object and the object.

Listen to this story.

(Verbal presentation of the relative clause sentence.)

(Demonstration of the relative sentence with the toy objects.)

Listen, again.

(Verbal presentation of the relative sentence.)

(Demonstration of the relative sentence with the toy objects.)

Listen just once more.

(Verbal presentation of the relative clause sentence.)

Now you can have a chance to make the same story.

(The position of the objects on the table is changed by the examiner.)

Show me the story; (Verbal presentation of the relative sentence.)

This training sequence was repeated for each target sentence.

Condition III

The training sequence for Condition III was the same as for Condition II, with the exception that for Condition III, conjoined sentences represented the training stimuli.

This training sequence was repeated for each target sentence.

Appendix E

Recording Forms

AM PM

Treatment Day

_____

Complex Sentence Comprehension Test

Response Sheet

Pretest Screening

Child's Name: _____ Age: _____ yrs. _____ mos. M F

Testing Envir.: _____

Telephone #: _____

Time begin: _____

Time End: _____

Total Time: _____

Date: _____

Sentence Type	RESPONSE			Repeat	ACTIONS - BEHAVIOR	REMARKS
	CR	Inc.	NR			
F/T//-A 1.						
Os-A 2.						
So-A 3.						
F/T\/-A 4.						
So-A 5.						
F/T//-A 6.						
So-A 7.						
Oo-A 8.						
Ss-A 9.						
F/T\/-A 10.						
SS-A 11.						
F/T//-A 12.						
Os-A 13.						
F/T\/-A 14.						
Oo-A 15.						
Os-A 16.						
F/T\/-A 17.						
Ss-A 18.						
F/T//-A 19.						
Oo-A 20.						

AM PM

Treatment Day

_____

Complex Sentence Comprehension Test

Response Sheet

Post Test #1 #2

Child's Name: _____ Age: ____yrs. ____mos. M F

Testing Envir.: _____

Telephone #: _____

Time begin: _____

Time End: _____

Total Time: _____

Date: _____

Sentence Type	RESPONSE CR	Inc	MR	Repeat	ACTIONS - BEHAVIOR	REMARKS
F/T//-A 1.						
Os-A 2.						
So-A 3.						
F/T\-A 4.						
So-A 5.						
F/T//-A 6.						
So-A 7.						
Oo-A 8.						
Ss-A 9.						
F/T\-A 10.						
SS-A 11.						
F/T//-A 12.						
Os-A 13.						
F/T\-A 14.						
Oo-A 15.						
Os-A 16.						
F/T\-A 17.						
Ss-A 18.						
F/T//-A 19.						
Oo-A 20.						

Data Transfer Sheet

Name: _____

Age: _____years _____mos.

Date: _____

Object Relatives			
#	S (So)	#	O (Oo)

Total #

CR: _____ _____

A: _____ A: _____

B: _____ B: _____

Subject Relatives			
#	S (Ss)	#	O (Os)

Total #

CR: _____ _____

A: _____ A: _____

B: _____ B: _____

For/To

#	//	#	X

Total #

CR: _____ _____

A: _____ A: _____

B: _____ B: _____

Intervention

Response Sheet

Training #: _____

Condition: _____

Treatment Day: _____

Name: _____ Age: _____ years _____months

Environment: _____

Date: _____

Time Begin.: _____

Time End: _____

Total Time: _____

S. T.	Response			Comments	Remarks
	CR	Inc.	NR		
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					

Total # CR: _____

Total % CR: _____

Appendix F

Individual Scores

INDIVIDUAL SCORES ON RELATIVE CLAUSE SENTENCES

Subject	Pretest				Posttest 1				Posttest 2			
	Oo	Ss	Os	So	Oo	Ss	Os	So	Oo	Ss	Os	So
1	0	0	0	1	1	0	2	1	2	2	2	0
2	1	0	0	0	0	0	1	1	0	0	1	1
3	0	0	0	0	1	1	0	1	2	1	2	1
4	0	1	1	0	1	1	2	2	0	2	3	1
5	1	2	1	0	3	2	1	2	2	3	3	1
6	0	2	2	0	2	3	2	2	2	2	3	3
7	0	1	0	0	1	2	0	2	3	1	2	1
8	0	1	0	0	0	1	1	0	1	2	3	1
9	1	1	2	0	3	1	3	0	1	3	3	2
10	0	1	1	0	3	2	1	0	3	2	1	0
11	0	1	0	0	2	0	2	0	2	1	1	1
12	1	1	1	0	1	2	3	1	1	2	2	2
13	0	1	0	0	0	1	0	0	0	1	1	0
14	1	0	2	1	1	2	1	0	1	3	0	1
15	0	3	0	0	0	1	1	0	0	1	1	0
16	0	0	0	1	1	1	0	0	1	1	0	0
17	0	1	1	0	0	2	2	0	0	2	1	1
18	0	0	0	0	1	1	1	0	1	2	0	0

Individual Scores on For/To Sentences

Subject	Pretest		Posttest 1		Posttest 2	
	F/T //	FT/\	F/T //	FT/\	FT //	FT /\
1	3	3	4	2	4	3
2	1	2	4	3	4	2
3	4	4	4	1	4	0
4	4	4	4	3	4	4
5	4	1	4	1	3	0
6	4	3	4	4	4	4
7	4	1	4	0	4	1
8	3	3	4	3	4	3
9	3	2	4	4	4	4
10	3	3	4	4	4	4
11	4	1	4	3	4	3
12	4	2	4	3	4	2
13	1	2	3	1	4	2
14	4	1	4	3	4	4
15	4	2	4	1	4	1
16	2	1	4	3	4	2
17	3	2	4	3	4	3
18	3	4	4	3	4	4

Appendix G

Nonpredicted Strategic Error Data

NUMBER OF NONPREDICTED STRATEGIC ERRORS ACCORDING TO SENTENCE TYPE, TESTING PERIOD (PRETEST, POSTTEST 1 = PT 1, POSTTEST 2 = PT 2), AND STRATEGY TYPE FOR CONDITION 1

Strategy	Sentence Type											
	Ss			Os			Oo			So		
	Pretest	PT 1	PT 2	Pretest	PT 1	PT 2	Pretest	PT 1	PT 2	Pretest	PT 1	PT 2
M Error	1	1	1	0	0	0	0	1	1	0	1	0
S Error	3	1	2	1	1	0	1	1	0	1	2	2
M + S Error	1	3	1	2	3	1	3	2	2	5	1	0
S Omit, M +	0	0	0	2	0	0	0	0	0	2	0	0
M Omit, S +	0	0	0	1	0	0	0	0	0	0	0	0
One-Clause (-)	1	0	0	2	0	0	2	0	0	0	0	0
Three-Clause	4	1	0	1	0	0	3	0	0	1	0	0
Total	10	6	4	9	4	1	9	4	3	9	4	2

NUMBER OF NONPREDICTED STRATEGIC ERRORS ACCORDING TO SENTENCE TYPE, TESTING PERIOD (PRETEST, POSTTEST 1 = PT 1, POSTTEST 2 = PT 2), AND STRATEGY TYPE FOR CONDITION 11

Strategy	Sentence Type											
	Ss			Os			Oo			So		
	Pretest	PT 1	PT 2	Pretest	PT 1	PT 2	Pretest	PT 1	PT 2	Pretest	PT 1	PT 2
M Error	0	0	0	1	1	1	2	1	0	1	1	1
S Error	4	2	0	1	0	1	0	1	0	1	2	0
M + S Error	4	0	1	8	2	2	7	2	0	3	4	1
S Omit, M +	1	0	0	2	0	0	1	0	0	0	0	0
M Omit, S +	0	0	0	0	0	0	0	0	0	0	0	0
One-Clause (-)	1	0	0	0	0	0	0	0	0	2	0	0
Three-Clause	1	0	0	1	0	0	1	0	0	3	0	0
Total	11	2	1	13	3	4	11	4	0	10	7	2

NUMBER OF NONPREDICTED STRATEGIC ERRORS ACCORDING TO SENTENCE TYPE, TESTING PERIOD (PRETEST, POSTTEST 1 = PT 1, POSTTEST 2 = PT 2), AND STRATEGY TYPE FOR CONDITION III

Strategy	Sentence Type											
	Ss			Os			Oo			So		
	Pretest	PT 1	PT 2	Pretest	PT 1	PT 2	Pretest	PT 1	PT 2	Pretest	PT 1	PT 2
M Error	1	0	3	4	0	2	0	0	1	0	0	0
S Error	7	2	3	2	2	0	1	1	0	2	3	1
M + S Error	3	2	1	5	4	1	7	4	2	3	4	2
S Omit, M +	0	0	0	0	0	1	0	0	0	0	1	0
M Omit, S +	0	0	0	0	0	0	0	0	0	0	0	0
One-Clause (-)	0	1	0	0	2	2	1	1	0	2	1	1
Three-Clause	2	0	0	1	0	0	2	0	0	2	0	0
Total	13	5	7	12	8	6	11	6	3	11	9	4

Appendix H

Permissions

UNIVERSITY OF MINNESOTA
TWIN CITIES

Department of Linguistics
142 Klaeber Court
320 16th Avenue S.E.
Minneapolis, Minnesota 55455
(612) 373-5788

September 18, 1979

Ms. Froma P. Roth
Chief of Speech Pathology
The John F. Kennedy Institute
707 North Broadway
Baltimore, Maryland 21205

Dear Ms. Roth:

I grant you permission to use Table 3 from my article, "The Role of Parallel Function in the Acquisition of Relative Clauses in English," JVLVB 13, 1974, p. 276.

Your dissertation sounds very interesting. Would it be possible for you to send me a copy of either a related paper or a brief description of your results?

Best wishes,

Amy Sheldon
Associate Professor

AS:mlt

THE JOHN F. KENNEDY INSTITUTE
FOR HANDICAPPED CHILDREN

707 NORTH BROADWAY
BALTIMORE, MARYLAND 21205
TELEPHONE 955-5000

SEP 11 1979

September 5, 1979

Publisher, Journal of Verbal Learning
and Verbal Behavior
Academic Press, Inc.
111 Fifth Avenue
New York, New York 10003

Dear Sir:

I am writing you for permission to include in my doctoral dissertation Table 3 from Amy Sheldon's article, The Role of Parallel Function in the Acquisition of Relative Clauses in English, JRLVB, 13, 1974, pg. 276.

As I am nearing completion of this work, I would greatly appreciate a prompt reply.

Thank you for your consideration.

Sincerely yours,

Froma P. Roth

Froma P. Roth
Chief of Speech Pathology

FPR/cw

PERMISSION GRANTED, provided that complete credit is given to the source.

September 12, 1979

.....
Rights and Permissions
Academic Press, Inc.

Please pardon the informality but to speed our reply we have answered on your own letter.

REFERENCES

Amidon, A., and Carey, P., Why-five-year olds cannot understand 'before' and "after". J. Verbal Lrng. and Verbal Beh., 11, 417-433 (1972).

Antinucci, F., and Parisi, D., Early semantic development in child language. In E. H. Lenneberg and E. Lenneberg (Eds.), Foundations of Language Development: A Multidisciplinary Approach, Vol. 1, New York: Academic Press (1975).

Bach, E., and Harms, R., Universals in Linguistic Theory. New York: Holt (1968).

Baird, R., Structural characteristics of clause-containing sentences and imitation by children and adults. J. Psycholing. Res., 2, 115-127 (1973).

Baird, R., Recall of embedded sentences: Perceptual or performance deficit? Bull. Psychonomic Soc., 3, 36-38 (1974).

Baird, R., and Koslick, J. D., Recall of grammatical relations with clause-containing sentences. J. Psycholing. Res., 3, 165-171 (1974).

Bates, E., Pragmatics and sociolinguistics in child language. In D. Morehead and A. Morehead (Eds.), Normal and Deficient Child Language, Baltimore: University Park Press (1976).

Bates, E., Camaioni, L., and Volterra, V., The acquisition of performatives prior to speech. Merrill-Palmer Q., 21, 205-226 (1975).

Beilin, H., Perceptual-cognitive conflict in the development of an invariant area concept. J. Exptl. Child Psychol., 1, 208-226 (1964).

Beilin, H., Stimulus and cognitive transormation in conservation. In D. Elkind and J. H. Flavell (Eds.), Studies in Cognitive Development: Essays in Honor of Jean Piaget. New York: Oxford University Press (1969).

Beilin, H., Experiments on the passive. In H. Beilin (Eds.), Studies in the Cognitive Basis of Language Development. New York: Academic Press (1975).

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

Beilin, H., and Kagan, J., Pluralization rules and the conceptualization of number. Developmental Psychol., 1, 697-706 (1969).

Bellugi, U., and Klima, E. S., Syntactic regularities in the speech of children. In J. L. Lyons and R. J. Wales (Eds.), Psycholinguistic Papers. Edinburgh: Edinburgh University Press (1966).

Bever, T. G., The cognitive basis for linguistic structures. In J. R. Hayes (Ed.), Cognition and the Development of Language, New York: Wiley (1970).

Bever, T. G., Fodor, J. A., and Garrett, M., The psychological segmentation of speech. Paper presented to the Intl. Congress of Psychol., Moscow (1966).

Bever, T. G., Lackner, J. R., and Kirk, R., The underlying structures of sentences are the primary units of immediate speech processing. Percep. Psychophys. 5, 225-231 (1969).

Bever, T. G., Mehler, J. R., and Valian, V. V., Linguistic capacity of very young children. In T. G. Bever and W. Weksel (Eds.), The Acquisition of Structure. New York: Holt, Rinehart, Winston (1970).

Bloom, L., Talking, understanding and thinking: Developmental relationship between receptive and expressive language. In R. L. Schiefelbusch and L. L. Llyod (Eds.), Language Perspectives - Acquisition Retardation, and Intervention. Baltimore: University Park Press (1974).

Bloom, L., (Ed.), Reading in Language Development. New York: Wiley (1978).

Bloom, L., and Lahey, M., Language Development and Language Disorders. New York: Wiley (1977).

Bloom, L., Rocissano, L., and Hood, L., Adult-child discourse: Developmental interaction between information processing and linguistic interaction. Cog. Psychol., 8, 521-552 (1976).

Blumenthal, A. L., Prompted recall of sentences. J. Verbal Lrng. and Verbal Beh., 6, 203-206 (1967).

Bowerman, M., Structural relationships in children's utterances: Syntactic or semantic? In. T. Moore (Ed.), Cognitive Development and the Acquisition of Language. New York: Academic Press (1973).

Bowerman, M., Semantic factors in the acquisition of rules for word use and sentence construction. In D. Morehead and A. Morehead (Eds.), Directions in Normal and Deficient Child Language. Baltimore: University Park Press (1976).

Bricker, W. A., and Bricker, D. D., A program for training the severely language handicapped child. Exceptional Children, 37, 101-113 (1970).

Bricker, W. A., and Bricker, D. D., An early language training strategy. In R. L. Schiefelbusch and L. L. Lloyd (Eds.), Language Perspectives - Acquisition, Retardation and Intervention. Baltimore: University Park Press (1974).

Broen, P. A., The verbal environment of the language-learning child. Monograph of ASHA. No. 17 (1972).

Brogan, P. The nesting constraint in child language. Language-Behavior Res. lab-Working Papers. No. 15, Berkeley, Ca.: University of California (1968).

Brown, H. D., Children's comprehension of relativized English sentences. Child Dvlpt. 42, 1923-1926 (1971).

Brown, R., The development of Wh questions in child speech. J. Verbal Lrng. and Verbal Beh., 7,279-290 (1968).

Brown, R. S., A First Language: The Early Stages. Cambridge, Mass: Harvard University Press (1973).

Brown, R., and Bellugi, U., Three processes in the child's acquisition of syntax. Harvard Educ. Review. 34, 133-151 (1964).

Brown, R., Cazden, C., and Bellugi, U., The child's grammar from I to III. In J. P. Hill (Ed.), Minnesota Sympos. on Child Psychol., Vol. II. Minneapolis: University of Minneapolis Press, 28-73 (1969).

Bruner, J., The ontogenesis of speech acts. J. Child Lang., 2, 1-19 (1975).

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

Cazden, C., Environment assistance to the child's acquisition of grammar. Doctoral dissertation, Harvard Univ. (1965).

Chappell, G. E., A cognitive-linguistic intervention program: Basic concept formation level. LSHSS, 8, 23-32 (1977).

Chomsky, C., The Acquisition of Syntax from Five to Ten. Cambridge, Mass.: M. I. T. Press (1969).

Chomsky, N., Aspects of the Theory of Syntax. Cambridge, Mass: M. I. T. Press (1965).

Chomsky, N., Linguistics and philosophy. In S. Hook (Ed.), Language and Philosophy. New York: New York Univ. Press (1969).

Clark, E., How young children describe events in time. In G. B. Flores d'Arcais and W. J. M. Levelt (Eds.), Advances in Psycholinguistics. New York: Am Elsevier (1970).

Clark, E., On the acquisition of before and after. J. of Verbal Lrng. and Verbal Beh., 10, 266-275 (1971).

Clark, E., Non-linguistic strategies and the acquisition of word meanings. Cognition, 2, 161-182 (1973).

Clark, E., Some aspects of the conceptual basis for first language acquisition. In R. Schiefelbusch and L. L. Lloyd (Eds.), Language Perspectives - Acquisition, Retardation, and Intervention. Baltimore: University Park Press (1974).

Clark, R. Performing without competence. J. Child Lang., 1, 1-10 (1974).

Cook-Gumperz, J., and Gumperz, J. J., Context in children's speech. Unpublished article (1975).

Cramblit, N. S., and Siegel, G. M., The verbal environment of a language-impaired child. J. of Speech and Lang. Disord., 42, 474-482 (1977).

Cromer, R., The development of temporal reference during the acquisition of language. Doctoral dissertation, Harvard Univ. (1968).

Cromer, R. "Children are nice to understand": Surface structure clues for the recovery of a deep structure. Brit. J. of Psychol., 61, 397-408 (1970).

Cromer, R., The development of the ability to decenter in time. Brit. J. of Psychol., 62, 353-365 (1971).

Davis, J., and Blasdell, R., Perceptual strategies employed by normal hearing and hearing-impaired children in the comprehension of sentences containing relative clauses. J. Speech Hearing Res., 18, 281-295 (1975).

deVilliers, P. A., and deVilliers, J. G., Early judgments of semantic and syntactic acceptability by children. J. of Psycholing. Res., 1, 299-310 (1972).

deVilliers, J., and deVilliers, P., A cross-sectional study of the acquisition of grammatical morphemes. J. Psycholing. Res., 2, 267-278 (1973).

deVilliers, J. G., and deVilliers, P. E., Language Acquisition. Cambridge, Mass.: Harvard University Press (1978).

Donahue, M. L., Conversational styles of mother-toddler dyads. Paper presented at the ASHA Convention, Chicago, Ill. (1977).

Dore, J., Holophrases, speech acts, and language universals. J. Child Lang., 2,. 21-40 (1975).

Dore, J., Children's illocutionary acts. In R. Freedle (Eds.), Discourse Relations: Comprehension and Production, Hinsdale, New Jersey: Lawrence Erlbaum Associates (1976).

Dore, J., "Oh them sheriff": A pragmatic analysis of children's responses to questions. In S. Ervin-Tripp and C. Mitchell-Kernan (Eds.), Child Discourse, New York: Academic Press (1977).

Edwards, A. L., Experimental Design in Psychological Research. New York: Holt (1950).

Elkind, D., Piaget's conservation problems. Child Dvlpt., 38, 15-27 (1967).

Ervin-Tripp, S. Discourse agreement: How children answer questions. In J. R. Hayes (Ed.), Cognition and the Development of Language. New York: Wiley (1970).

Feier, C. D., Comprehension of spoken sentences containing relative clauses by adults of varying ages. Doctoral dissertation, City Univ. of New York (1977).

Feldman, C. F., and Rodgon, M. The effects of various types of adult responses in the syntactic acquisition of two-to-three-
year olds. Unpubl. paper. Dept. Psychol., University of Chicago (1970).

Ferguson, C. A., Baby talk as a simplified register. In C. E. Snow and C. A. Ferguson (Eds.), Talking to Children: Language Input and Acquisition. Cambridge, Mass.: Cambridge University Press (1977).

Ferreiro, E., and Sinclair, H., Temporal relations in language. Intl. J. of Psychol., 6, 39-47 (1971).

Fodor, J. A., Recognition of syntactic structures. In D. L. Horton and J. J. Jenkins (Eds.), The Perception of Language. Columbus, OH.: Merrill, 120-139 (1971).

Fodor, J. A., and Bever, T. G., The psychological reality of linguistic segments. J. Verbal Lrng. and Verbal Beh. 4, 414-420 (1965).

Fodor, J. A., Bever, T. G., and Garrett, M. F., The Psychology of Language. New York: McGraw-Hill Book Co. (1974).

Fodor, J. A., and Garrett, M., Some syntactic determinants of sentential complexity. Percep. Psychophys., 2, 289-296 (1967).

Forster, K. I., and Olbrei, I. Semantic heuristics and syntactic analysis. Cognition, 2, 319-347 (1973).

Foss, D. J., and Lynch, R. H., Decsion processes during sentence comprehension: Effects of surface structure on decision time. Percep. Psychophys., 5. 145-148 (1969).

Gallagher, T. M., and Darnton, B. A., Revision behaviors in the speech of language disordered children. Paper presented at the Second Annual Boston Univ. Conf. on Lang. Dvlpt., Boston, Mass. (1977).

Garnica, O. K., Some prosodic and paralinguistic features of speech to young children. In C. E. Snow and C. A. Ferguson (Eds.), Talking to Children: Language Input and Acquisition. Cambridge, Mass.: Cambridge University Press (1977).

Garrett, M. F., Syntactic structures and judgments of auditory events. Doctoral dissertation, Univ. of Illinois (1965).

Garrett, M. F., Bever, T. G., and Fodor, J. A., The active use of grammar in speech perception Percep. Psychophys., 1, 30-32 (1966).

Garvey, C., The contingent query: A dependent act in conversation. In M. Lewis and L. A. Rosenblum (Eds.), Interaction, Conversation, and the Development of Language, New York: John Wiley and Sons (1977).

Garvey, C., Requests and responses in children's speech. J. Child Lang., 2, 41-60 (1975).

Gleason, J. B. Talking to children: Some notes on feedback. In C. E. Snow and C. A. Ferguson (Eds.), Talking to Children: Language Input and Acquisition. Cambridge, Mass.: Cambridge University Press (1977).

Gough, P. B. Grammatical transformations and speed of learning. J. Verbal Lrng. and Verbal Beh., 4, 107-111 (1965).

Grice, H. P., Logic and conversation. In P. Cole and J. L. Morgan (Eds.), Syntax and Semantics. Vol. 3, Speech Acts. New York: Academic Press (1975).

Gruber, J., Performative - constative transition in child language. Found. Lang., 12, 513-521 (1975).

Guralnick, M. J., and Paul-Brown, D., Nonhandicapped children's speech to handicapped children: Functional and structural analyses. Paper presented to the 102nd Ann. Mtg. of the Amer. Assoc. of Mental Deficiency, Denver (1978).

Hakes, D., Evans, J., and Brannon, L., Understanding sentences with relative clauses. Memory and Cognition. 4, 283-290 (1976).

Hakes, D., and Foss, D., Decision processing during sentence comprehension: Effects of surface structure reconsidered. Percep. Psychophys., 8, 413-146 (1970).

Halliday, M. A. K., Explorations in the Functions of Language. London: Edward Arnold (1973).

Halliday, M. A. K., Learning How to Mean: Explorations in the Development of Language. London: Edward Arnold (1975).

Hymes, D., Competence and performance in linguistic theory. In R. Huxley and E. Ingram (Eds.), Language Acquisition: Models and Methods. New York: Academic Press (1971).

Jacobs, R. A., and Rosenbaum, P. S., English Transformational Grammar. Waltham, Mass.: Blaisdell (1968).

Kagan, J., Kearsely, R. B., and Zelazo, P. R., Infancy: Its Place in Human Development. Cambridge, Mass.: Harvard University Press (1979).

Keenan, E. O., Conversational competence in children. J. Child Lang., 1, 163-168 (1974).

Keenan, E., and Schieffelin, B., Topic as a discourse notion: A study of topic in the coversations of children and adults. In C. Li (Ed.), Subject and Topic. New York Academic Press (1976).

Kessel, F. S., The role of syntax in children's comprehension from ages six to twelve. Monographs of the Soc. for Res. in Child Dvlpt., 35, 6, Serial No. 139 (1970).

Labov, W. The social stratification of English in New York City. Washington, D.C.: Center for Applied Linguistics (1966).

Ladefoged, P., and Broadbent, D. E., Perception of sequence in auditory events. Quarterly J. of Exptl. Psychol., 13, 162-170 (1960).

Lee, L., Northwestern Syntax Screening Test. Evanston, Ill.: Northwestern University Press (1969).

Lee, L., and Canter, S., Developmental sentence scoring: A clinical procedure for estimating syntactic development in children's spontaneous speech. J. Speech Hear. Disord., 36, 315-338 (1971).

Lee, L., Koenigsknecht, R. A., and Mulhern, S. T., Interactive Language Development Teaching: The Clinical Presentation of Grammatical Structure. Evanston, Ill.: Northwestern University Press (1975).

Lenneberg, E. H., Biological Foundations of Language. New York: Wiley (1967).

Limber, J., The genesis of complex sentences. In T. E. Moore (Ed.), Cognitive Development and the Acquisition of Language. New York: Academic Press (1973).

MacDonald, J. D., and Blott, J. P., Environmental language intervention: The rationale for a diagnostic and training strategy through rules, context, and generalization. J. Speech Hear. Disord., 39, 244-256 (1974).

McNeill, D., Developmental psycholinguistics. In F. Smith and G. Miller (Eds.), The Genesis of Language. Cambridge, Mass.: M. I. T. Press (1966).

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

Menyuk, P., The Acquisition and Development of Language. Englewood Cliffs, N.J.: Prentice-Hall (1971).

Miller, G., Some psychological studies of grammar. American Psychologist. 17, 748-762 (1962).

Miller, G. A., and Chomsky, N., Finitary models of language users. In R. D. Luce, R. R. Bush, and E. Galanter (Eds.), Handbook of Mathematical Psychology. Vol. II. New York: Wiley (1963).

Miller, G. A., and Isard, S., Free recall of self-embedded English sentences. Information and Control, 7, 292-303 (1964).

Miller, J., and Yoder, D., A snytax teaching program. In J. E. McLean, D. E. Yoder, and R. L. Schiefelbush (Eds.), Language Intervention with the Retarded: Developing Strategies. Baltimore: University Park Press (1972).

Miller, J., and Yoder, D., An ontogenic language teaching strategy for retarded children. In R. Schiefelbusch and L. Lloyd (Ed.), Language Perspectives - Acquisition, Retardation and Intervention. Baltimore: University Park Press (1974).

Nelson, K., Early speech in its communicative context. Paper presented at the Conf. on Early Behaviroal Assessment of the Comm. and Cog. Abilities of the Dvlptly. Disabled Child. Washington: Orcas Island (1976).

Newport, E. L., Gleitman, H., and Gleitman, L. R., Mother, I'd rather do it myself: Some effects and non-effects of maternal speech style. In C. E. Snow and C. A. Ferguson (Eds.), Talking to Children: Language Input and Acquisition. Cambridge, Mass.: Cambridge University Press (1977).

Olds, H. F., An experimental study of syntactic factors influencing children's comprehension of certain complex relationships. Center for Res. and Dvlpt. on Educ. Differences. Report No. 4, Cambridge, Mass: Harvard University Press (1968).

Phillips, J., Syntax and vocabulary of mothers' speech to young children: age and sex comparisons. Child Dvlpt., 44, 182-185 (1973).

Piaget, J., The Origins of Intelligence in Children. New York: International University Press (1952).

Piaget, J., and Inhelder, B., The Child's Conception of Number. Paris; Delachaux and Niestle (1941).

Piaget, J., Inhelder, Barbel, and Szeminska, A., The Child's Conception of Geometry. London: Routledge and Kegan (1960).

Rees, N. Bases of decision in language training. J. Sp. and Hrg. Dis., 37, 283-305 (1972).

Rees, N. S., Pragmatics of language: Applications to normal and disordered language development. In R. L. Schiefelbusch (Ed.), Bases of Language Intervention. Baltimore: University Park Press (1978).

Sachs, J., The adaptive significance of linguistic input to prelinguistic infants. In C. E. Snow and C. A. Ferguson (Eds.), Talking to Children: Language Input and Acquisition. Cambridge, Mass.: Cambridge University Press (1977).

Sachs, J., Talking about there and that, The Stanford Papers and Reports on Child Lang. Dvlpt., Stanford, Ca.: Stanford University Press (1977).

Sachs, J., Brown, R., and Salerno, R., Adult speech to children. Paper presented at the Intl. Symp. on First Lang. Acq., Florence, Italy (1972).

Sachs, J., and Devin, J., Young children's use of age appropriate speech tyles in social interaction and role-playing. J. of Child Lang., 3, 81-98 (1976).

Sacks, H., Schegloff, E. A., and Jefferson, G., A simplistic systematics for the organization of turn taking in conversation. Language, 50, 696-735 (1974).

Savin, H., and Perchonock, E., Grammatical structure and the immediate recall of English sentences. J. Verbal Lrng. and Verbal Beh., 4, 348-353 (1965).

Schlesinger, I. M., The production of utterances and language acquisition. In D. I. Slobin (Ed.), The Ontogenesis of Grammar. New York: Academic Press (1971).

Schlesinger, I., M., The role of cognitive development and linguistic input in language acquisition. J. Child Lang., 4, 153-169 (1977).

Shatz, M., and Gelman, R., The development of communication skills: Modifications in the speech of young children as a function of the listener. Monographs of the Soc. for Res. in Child Dvlpt., 38, Serial No. 152 (1973).

Shatz, M., and Gelman R., Beyond syntax: The influence of conversational constraints on speech modifications. In C. E. Snow and C. A. Ferguson (Eds.), Talking to Children: Language Input and Acquisition. Cambridge, Mass.: Cambridge University Press (1977).

Sheldon, A. The acquisition of relative clauses in English. Doctoral dissertation, Univ. of Texas, Austin (1972).

Sheldon, A. The role of parallel function in the acquisition of relative clauses in English. J. Verbal Lrng. and Verbal Beh., 13, 272-381 (1974).

Sheldon, A., On strategies for processing relative clauses: A comparison of children and adults. J. Psycholing. Res., 4, 305-318 (1977).

Shipley, E. S., Smith, C. S., and Gleitman, L. R., A study in the acquisition of language: Free responses to commands. Language, 45, 322-342 (1969).

Sinclair-de-Zwart, H., Language acquisition and cognitive development. In T. E Moore (Ed.), Cognitive Development and the Acquisition of Language. New York: Academic Press (1973).

Slobin, D. I. Grammatical transformations and sentence comprehension in childhood and adulthood. J. Verbal Lrng. and Verbal Beh. 5, 219-227 (1966).

Slobin, D. I., Universals of grammatical development in children. In G. B. Flores d'Arcais and W. J. M. Levelt (Eds.), Advances in Psycholinguistics. Amsterdam: North Holland (1970).

Slobin, D. I., Developmental psycholinguistics. In W. O. Dingwall (Ed.), A Survey of Linguistic Science. College Park, Md.: Linguistics Prog., Univ. of Maryland, 298-400 (1971).

Slobin, D. I., Cognitive prerequisites for the development of grammar. In C. A. Ferguson and D. I. Slobin (Eds.), Studies of Child Language Development. New York: Holt, 175-208 (1973).

Smedslund, J., The acquisition of conservation of substance and weight in children: I. Scand. J. of Psychol., 2, 11-20 (1961a).

Smedslund, J. The acquisition of substance and weight in children. III. Extinction of conservation of weight acquired "normally" and by means of empirical controls as a balance scale. Scand. J. of Psychol., 2, 85-87 (1961b).

Snow, C. E., Mothers' speech to children learning language. Child Dvlpt., 43, 549-565 (1972).

Snow, C., Mothers' speech research: An overview. Paper presented at the Conf. on Lang. Input and Acq., Boston, Mass. (1974).

Stoel-Gammon, C., and Coggins, T. E., Making yourself understood: A study of self-correction strategies in the spontaneous speech of Down's Syndrome children. Paper presented at the Second Annual Boston Univ. Conf. on Lang. Dvlpt. Boston, Mass. (1977).

Stolz, W. S., A study of the ability to decode grammatically novel sentences. J. Verbal Lrng. and Verbal Beh., 6, 867-873 (1967).

Thomas, Lewis, The Medusa and the Snail: More Notes of a Biology Watcher. New York: Viking (1979).

Toler, S. A., and Bankson, N. W., Utilization of an interrogative model evaluate mother's use of question forms. J. Speech and Lang. Disord., 41, 301-314 (1976).

Walker, E., Grammatical relations in sentence memory. Doctoral dissertation, Indiana Univ. (1969).

Wallach, G. P., The implications of different language comprehension strategies in learning disabled children: Effects of thematization. Doctoral dissertation, City Univ. of New York (1977).

Wanner, E., and Maratsos, M., On understanding relative clauses. Unpublished paper, Harvard University (1971). Cited in Fodor, J. A., Bever, T. G., and Garrett, M. F., The Psychology of Language. New York: McGraw-Hill (1974).

Wohlwill, J. F., and Lowe, R. C., Experimental analysis of the development of the conservation of number. Child Dvlpt., 33, 153-167 (1962).